

WSR-88D BUILD 9.0 PRECURSOR TRAINING

Preface

IMPORTANT NOTE!!

This version of the WSR-88D Build 9.0 Precursor Training document has been updated since the original printing! An addendum sheet to Appendix B, paragraph 6 was shipped with the original printing of the document. The addendum has been incorporated into this document.

Minor typographical changes have been made to the text. In addition, some product examples have been changed to include full color versions. These examples may be different versions of products presented in the printed version, but illustrate the same important issues.

This training material provides a summary of the major changes in the WSR-88D Build 9.0 software that will impact UCP and PUP operators. We recommend that UCP and PUP operators either read this document or complete the *WSR-88D Interactive Training Module -- Introduction to Build 9.0* before the Build 9.0 software arrives on site. This document can then be added to the WSR-88D technical library for quick reference once Build 9.0 is loaded on the WSR-88D system.

A second phase to Build 9.0 training, "Quick Start Training", will be included with the Build 9.0 Release Kit. The Quick Start Training provides "job sheets" that "walk" the operator through the most critical new and revised UCP and PUP functions. The purpose of this training is to help WSR-88D operators prepare to use their system operationally with the new Build 9.0 functionality.

Build 9.0 adds several new capabilities, products, and algorithms. Operators will need to study these materials and exercise the Build 9.0 software to find their "comfort zone" before they can fully utilize the added capability Build 9.0 provides. This sequence of training materials is aimed at providing WSR-88D operators the capability to use their WSR-88D to support forecast and warning operations immediately after loading the Build 9.0 software.

This precursor training material references the following Build 9.0 documentation. When the Build 9.0 documentation arrives, we encourage operators to study the portions that pertain directly to their operations.

1. Build 9.0 Quick Start Training,
2. Change pages to the PUP WSR-88D Operator Handbooks,
3. WSR-88D Operator Handbook, Unit Control Position, Job Sheets (for RPG sites only), and
4. A new baseline document--*WSR-88D Guidance on Adaptable Parameter Handbook* (for RPG sites only).

The *WSR-88D Guidance On Adaptable Parameter Handbook* defines the specific adaptable parameters that fall under each Level of Change Authority that can be changed at the UCP. Example screens for each parameter are provided along with the baseline value for each adaptable parameter.

Build 9.0 is the first OSF-developed software release with major functionality changes at the RPG and PUP (e.g., new SCIT and Hail algorithms and products). These changes produced some unavoidable incompatibilities between the Builds 8.0 and 9.0. The specific incompatibilities between the software builds are as follows:

Build 8.0 PUP connected to Build 9.0 RPG:

- One-Hour Precip (OHP), Three-Hour Precip (THP), and Storm Total Precip (STP) products will display as blank or corrupted products
- Storm Track Information (STI) product - corrupted data is displayed
- Hail (HI) product - corrupted data is displayed
- Composite Reflectivity (CR) - Combined Attributes grid blinks
- Storm Structure (SS) - product does not display
- The following six alert categories will not work at a Build 8.0 APUP:
 - Hail (Volume and Forecast Groups)
 - Maximum Storm Velocity (Volume and Forecast Groups)
 - Storm Volume (Volume and Forecast Groups)

Build 9.0 PUP connected to Build 8.0 RPG:

- Cannot display a time lapse of precip products (OHP, THP, or STP)
- The following six alert categories for Build 8.0 will not work:
 - Hail Index (Volume and Forecast Groups)
 - Max Storm Velocity (Volume and Forecast Groups)
 - Storm Volume (Volume and Forecast Groups)
- The following Build 9.0 functionality will not work
 - User Selectable Precip (USP) and Clutter Filter Control (CFC) cannot be requested or displayed
 - SPD will not display
 - Volume scan time for alerts (S,AL) is not properly displayed on the PUP screen

The Operations Training Branch would like to acknowledge our many colleagues that assisted us in the preparation and review of this document. Members of the Applications Branch, Engineering Branch, and Operations Branch of the OSF answered countless questions, and provided thorough reviews of both this document and the Interactive Training Module. It is hoped that the

reader may find that their vast knowledge of the WSR-88D System is reflected in this document. The authors also wish to thank the staff members of the Build 9.0 Beta Test sites who provided invaluable operational insight as to the quality of these training materials.

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New Algorithms/ Products

Storm Cell Identification and Tracking

Introduction

The new Storm Cell Identification and Tracking (SCIT) algorithm is one of the major Build 9.0 enhancements. The objective of the algorithm is to identify, track, and forecast the movement of storm cells. The primary graphic product produced by this algorithm is the Storm Track Information (STI - Product ID # 58).

Data developed by this algorithm are used extensively as input to several other products (i.e., SRM, SRR, WER, HI, SS, M, TVS, RCM, CR Combined Attribute Table) and the new Cell Trends display. Previously, the Storm Series algorithms produced these data.

Prior to the release of Build 9.0, a single-reflectivity threshold (30 dBZ) was used to identify storms, therefore large areas of reflectivity greater than 30 dBZ (i.e., squall lines, Mesoscale Convective Complexes, tropical storms) were identified as one storm. This led to poor tracking and forecast performance. The new SCIT algorithm uses seven thresholds (30, 35, 40, 45, 50, 55, 60 dBZ) and has shown a dramatic improvement in the identification, tracking, and forecast movement of individual cells in lines or clusters.

SCIT Algorithm Overview

The SCIT algorithm consists of four subfunctions: Storm Cell Segments, Storm Cell Centroids, Storm Cell Tracking, and Storm Position Forecast. The *Storm Cell Segments* subfunction identifies the radial sequences of reflectivity or segments, and outputs information on these segments to the *Storm Cell Centroids* subfunction. The *Storm Cell Centroids* subfunction groups the segments into two-dimensional components, vertically correlates these components into three-dimensional cells, and calculates these cells' attributes. The cells and their attributes are output to Storm Cell Tracking and Storm Position Forecast. *Storm Cell Tracking* monitors the movement of the cells by matching cells found in the current volume scan to the cells from the previous volume scan. *Storm Position Forecast* predicts future centroid locations based on a history of the cell's movement.

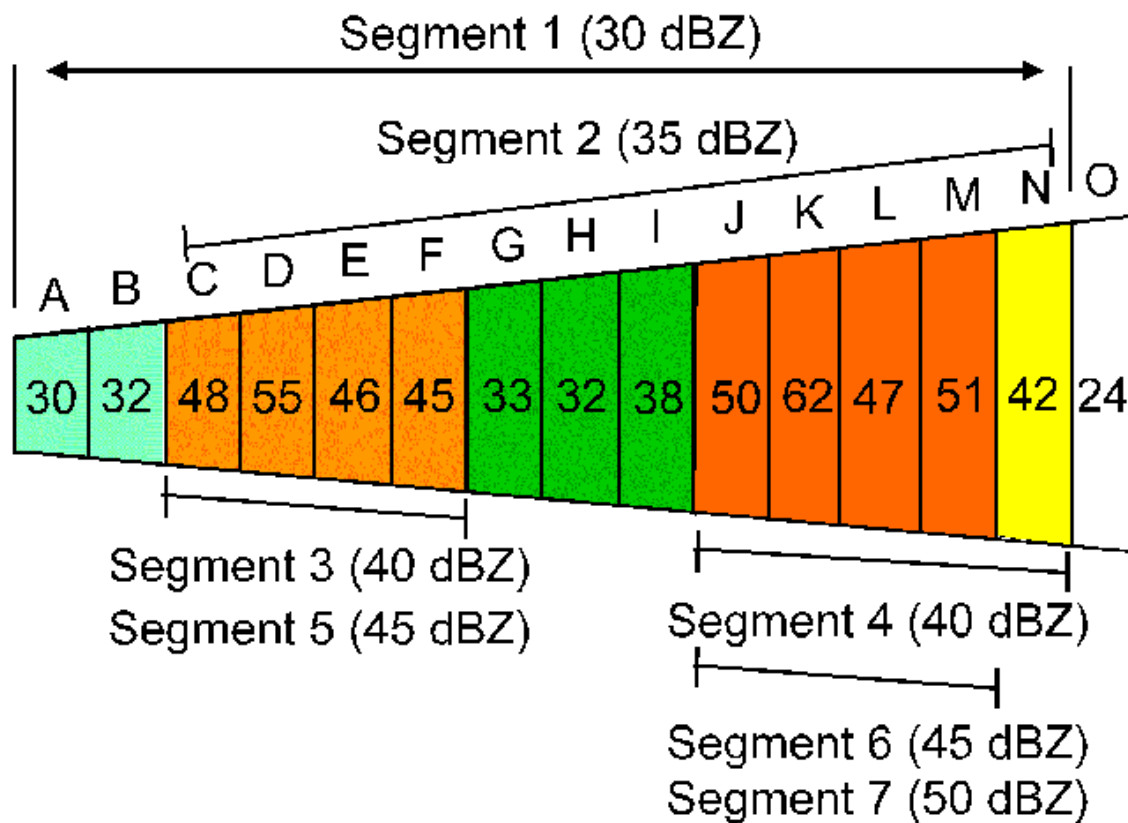
Storm Cell Segments

A *segment* is a run of contiguous range bins along a radial with reflectivity values greater than or equal to a specified threshold. The *Storm Cell Segments* subfunction searches for segments of up to seven different minimum reflectivity thresholds (defaults are 30, 35, 40, 45, 50, 55, 60 dBZ). The segment must have a combined length greater than a minimum segment length (1.9 km/1.1

nm), and may contain a specified dropout number (2) of contiguous range bins that are within a range (5 dBZ) below the minimum reflectivity threshold.

The *Storm Cell Segments* subfunction searches for segments on each radial as the data arrives at the RPG. First, a search is done for segments of the lowest minimum reflectivity (default is 30 dBZ). All other range bins are discarded from further processing. Then a search is made of the detected (30 dBZ) segments for segments of the next minimum reflectivity threshold (35 dBZ). Then a search of those (35 dBZ) segments is made for segments of the next threshold (40 dBZ), and so on through the seventh threshold (60 dBZ).

A portion of a radial is depicted in the graphic below and annotated with the reflectivity values of each (10 x 0.54 nm) range bins. Given the default values of the adaptable parameters seven segments would be defined.



In the initial search for a 30 dBZ segment (labeled Segment 1), only the range bin labeled "O" would be eliminated. Segment 2 ("C" through "N") would be selected in the search for 35 dBZ segments (range bins "G" and "H" would remain *since up to two contiguous range bins within 5 dBZ of the minimum reflectivity threshold can be contained in the segment*). The 40 dBZ segments would include Segment 3 ("C through F") and Segment 4 ("J through N"). Segments 5 and 6 would be defined as 45 dBZ segments, and Segment 7 would be further defined as a 50 dBZ segment. Note that range bin "D" (55 dBZ) and range bin "K" (62 dBZ) would not be considered separate segments since they do not exceed the minimum segment length.

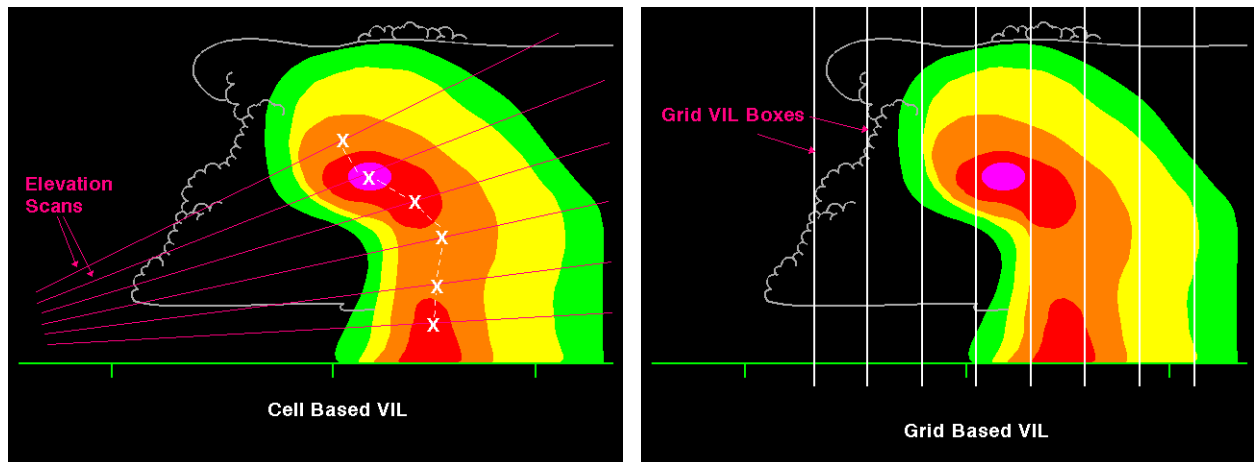
Storm Cell Centroids

At each elevation slice, the *Storm Cell Centroids* subfunction groups adjacent segments of each reflectivity threshold into two-dimensional components. If components overlap, the component with the higher reflectivity is saved and the other(s) discarded. *Only the smaller “bull’s eyes” of high reflectivity are saved for correlation into three-dimensional cells. Therefore, cells are defined by their areas of highest reflectivity.*

The components are vertically correlated by comparing the proximity of the centers of every component with those in adjacent elevation scans. Components with the largest masses are compared first. If at least two components are vertically correlated, a cell is created. The following cell attributes are then calculated: centroid (in polar coordinates), height of the centroid (ARL - Above Radar Level), maximum (3-bin averaged) reflectivity, height of the maximum reflectivity (beam centerpoint height - ARL), cell base and top, number of components, and Cell-based Vertically Integrated Liquid (VIL).

Cell-based VIL

A calculation of VIL is made for each cell identified by *Storm Cell Centroids* by vertically integrating maximum reflectivity values of a cell's correlated components. This is a different calculation than the gridded VIL product (VIL - Product ID #57--which remains unchanged). As can be shown on the following example, a fast-moving or highly tilted storm will usually have a higher Cell-based VIL than Grid-based VIL.



Up to 100 cells can be identified by Storm Cell Centroids. The cells are ranked by Cell-based VIL. Cell-based VIL is displayed in Cell Trends (see below), the Storm Structure Alphanumeric Product, and the Composite Reflectivity Combined Attribute Table.

Storm Cell Tracking

Storm Cell Tracking monitors the movement of storm cells by matching cells found in the current volume scan to the cells from the previous volume scan. Starting with the cell with the highest Cell-based VIL, a comparison is done of its centroid location with the projected (based on past

movement) centroids from the previous volume scan. The closest projected centroid within a threshold distance is considered the same cell. Directional limitations placed on tracking by the earlier algorithm have been eliminated from Storm Cell Tracking. The ID assigned to a cell consists of a letter-number combination (A0,B0,C0,...Z0,A1,B1...Z1,A2, B2,...,Z9). This adds some value to the ID, such as cell R7 has been identified longer than cell H8 (the number has precedence over the letter in this scheme). The cell ID scheme resets after the track reset period (default is 20 cell-free minutes).

Storm Position Forecast

Storm Position Forecast predicts the future centroid locations of storm cells based on a history of the cell's movement. This portion of the SCIT algorithm is very similar to the Build 8.0 algorithm in using an identified cell's previous movement over several volume scans and the variance of the forecast movement to output a forecast movement up to 60 minutes in the future. The length of a forecast (0, 15, 30, 45, or 60 minutes) is related to the accuracy of the previous volume scan's forecast. The larger the error in past volume scan's forecast, the shorter (in time) the forecast.

Storm Track Information Graphic Product

Data developed by the SCIT algorithm is directly input to the Storm Track Information Product (STI - Product ID #58). This product has noticeable differences from the product of the same name in earlier software builds. The STI product can now display up to 100 cells identified by the SCIT algorithm on a single product. It is also possible to display the actual past positions of the centroid on up to 13 (default 10) previous volume scans, not 15 minute interpolation positions as before. Cells with a movement of less than a minimum speed (default 5 kts) are circled to indicate little movement (as cell A1 in the example on the following page), and past positions and forecast tracks are not displayed.

During active weather, the STI product could become extremely cluttered. Therefore, adaptable parameters are available at the PUP to keep the product from becoming cluttered. The new **AD,<PASSWORD>,S** menu at the PUP Applications Terminal has three display parameters that affect the STI graphic product. The PUP operator can select the number of identified cells to be displayed (up to 100), and whether or not to display the past positions and/or forecast positions. If the PUP operator selects only 10 cells to be displayed, and the SCIT algorithm has identified 52 cells, there will be a text line in the lower left corner of the STI graphic product stating "42 CELLS IN WINDOW NOT DISPLAYED", and the 42 cells with the lowest Cell-based VIL will not be displayed on the product. If in this example, a magnification of 4X is made on an geographic area that contains 12 cells, the product displays the 10 cells in that area with the highest Cell-based VIL and the line "2 CELLS IN WINDOW NOT DISPLAYED". If the magnified area had 10 or fewer identified cells, all the cells in that geographic area would be displayed, and no text would be displayed in the lower left corner.

The STI Attribute Table appears at the top of the STI product (color coded cyan), and contains information on all identified cells. If 100 cells were identified, with only six cells per page, there would be 17 pages of attributes. Narrowband transmission time would be greater in this type of active weather situation and narrowband loadshedding may become a problem (see Cell Product

Parameter Section). At the UCP's (**SE**,<**PASSWORD**>,<**CE**>) menu, limiting the number of identified cells in the attribute table can reduce the potential for loadshedding. The STI Attribute Table lists the cells in order of Cell-based VIL from left to right from page 1 to the last page. On the first volume scan a cell is identified, the word "NEW" is placed on the line for forecast movement (Cell "S5" in the example below). For correlation purposes "NEW" cells are assigned a default cell motion as defined on the E,H menu at the UCP (URC authority).



Storm Track Information Product

Storm Track Information Alphanumeric Product

The STI Alphanumeric Product displayable at the Applications Terminal (**D,A,STI**) contains information on the position and forecast of identified cells. The average speed and direction of all identified cells are shown near the top of page 1. Cells are listed in order of Cell-based VIL. The azimuth and range of the current cell centroids along with the movement and forecast positions at 15, 30, 45, 60 minutes are listed.

Composite Reflectivity Combined Attribute Table

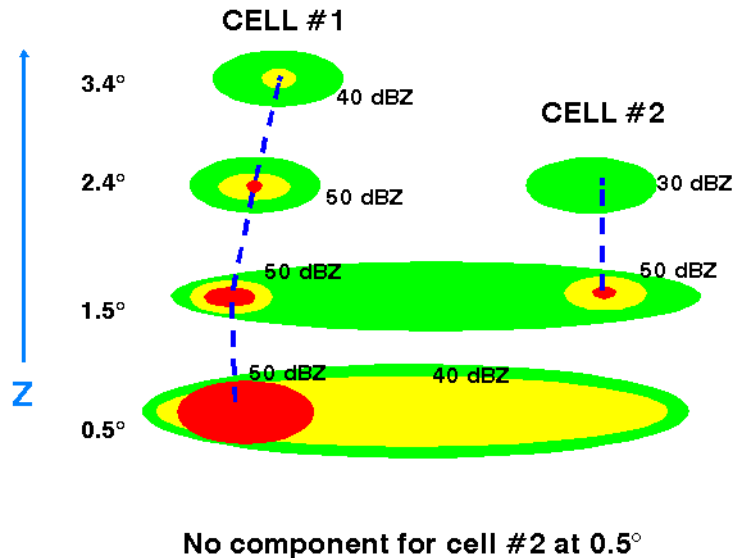
Centroid Location (AZRAN), Cell-based VIL, Maximum Reflectivity, Height of Maximum Reflectivity, Cell Top, and Forecast Movement from the SCIT are listed on the Combined

Attribute Table at the top of the Composite Reflectivity Products (color coded orange). Other attributes include POSH (Probability of Severe Hail), POH (Probability of Hail), and maximum size from the Hail Detection Algorithm; an indication of “YES” or “NO” from the Tornadoic Vortex Signature Algorithm (TVS); and an indication of “YES” or “NO” from the Mesocyclone Algorithm. The ordering of the cells in this Attribute Table is: TVS, MESO, 3D Correlated Shear, Uncorrelated Shear, POSH, POH, and Cell-based VIL.

Limitations

Although the new SCIT algorithm has demonstrated improvement in the identification of cells in close proximity, errors may still occur in the cell attributes calculated in these situations. Recall from the previous discussion of Storm Cell Centroids that *storm cells are defined by areas of highest reflectivity*.

In the example to the right, a particularly high area of reflectivity occurred in Cell #1 at 0.5°, and only this area was saved as a component. Cell #2 has been identified with a Cell Base defined at the 1.5° slice even though a 40 dBZ echo exists at the 0.5° slice.



This type of problem will also affect other calculations such as Cell Top, Maximum Reflectivity Height, and Cell-based VIL. ***The operator should be skeptical of cell attributes anytime cells are in close proximity to each other.***

Calculations of Cell-based VIL, Cell Top and Base, Height of Maximum Reflectivity, etc. can all be adversely affected by what the radar is *not* sampling. Large errors can occur in attributes of cells close to the RDA, especially in VCP 21, where there are large gaps between elevation angles at higher slices, and in cells within the cone of silence.

The limitations on these attributes should also be considered anytime the operator uses the Cell Trends Display described in a later section of this document.

Strengths/Applications

The SCIT algorithm shows a high degree of skill in identifying distinct individual cells occurring in lines or clusters. This ability to identify individual cells leads to better tracking and forecast results. This improvement can be realized not only in an improved Storm Track Information Product, but also in improved Storm Relative Velocity products (SRM, SRR). Better cell identi-

cation results in an improved Hail Index product. Improved cell attribute calculations lends value to tracking these attributes in time with the new Cell Trends display.

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page R-30 and Volume II, Applications Terminal, Page R-29.
- WSR-88D Operator Handbook, Unit Control Position, Job Sheets, Pages 11, 14, 113, and 118.

Storm Structure Alphanumeric Product

Storm Structure (SS - Product ID # 62) is an alphanumeric product and can only be displayed on the Applications Terminal at the PUP (**D,A,SS**). This product must be in the PUP data base for Cell Trends to be displayed, and is therefore recommended for the RPS list.

Data from the one volume scan (start date/time listed) is displayed on the Storm Structure product. The number of storm cells detected is given on the second line of the product. This number may be greater than the number of cells listed in the table since the number of cells listed in the table may be limited at the UCP in the SE,<PASSWORD>,CE menu.

The Storm Structure alphanumeric product includes many of the cell attributes calculated by the SCIT algorithm:

- Column 1: STORM ID (the cells are ordered by Cell-based VIL)
- Column 2: AZRAN DEG/NM (the azimuth and range to the centroid)
- Column 3: BASE KFT (the height of the beam centerpoint at the center of the lowest component detected, prefaced by "<" if on the lowest (0.5°) slice)
- Column 4: TOP KFT (the height of the beam centerpoint at the center of the highest component detected, prefaced by ">" if on the highest (19.5°) slice)
- Column 5: CELL BASED VIL KG/M**2
- Column 6: MAX REF DBZ (the maximum reflectivity found in the cell)
- Column 7: HEIGHT KFT (the height of the maximum reflectivity)

All SCIT adaptation data (segments, centroids, tracking, and forecast) appears on the last pages of the Storm Structure Alphanumeric Product.

Limitations

All of the data listed in the Storm Structure alphanumeric product is also available for each individual cell in the Cell Trends graphic display. Some of the information (ID, AZRAN, MAX REF, HEIGHT) is available on the STI graphic product. Some of the information (ID, AZRAN, TOP, CELL BASED VIL, MAX REF, HEIGHT) is available in the Combined Attribute Table on the Composite Reflectivity products. Graphic displays of this information are preferred by most operators over the alphanumeric display.

See the sections on SCIT and Cell Trends for limitations on cell attribute data listed in the Storm Structure product.

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page R-29.
- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page R-30.

ALPHA PRODUCT 62 (SS KMLB 22:27 03/06/92) Page 1 of 5						
COMMAND: D,A,						
FEEDBACK: EXECUTED - D,A,SS						
STORM STRUCTURE						
RADAR ID 302 DATE/TIME 03:06:92/22:27:55 NUMBER OF STORM CELLS 18						
STORM ID	AZRAN DEG/NM	BASE KFT	TOP KFT	CELL BASED VIL KG/M**2	MAX REF DBZ	HEIGHT KFT
C0	311/ 44	< 3.8	36.4	54	65	17.1
D2	144/ 10	< 0.5	>20.7	34	67	15.0
G3	310/104	<13.1	23.9	21	53	13.1
Y2	295/ 14	< 0.9	>21.2	18	56	6.5
C3	319/ 80	< 8.8	24.8	17	52	8.8
L2	324/ 59	< 5.5	17.5	15	52	5.5
G0	338/ 57	< 5.3	22.3	11	49	5.3
H3	310/ 54	< 4.8	15.5	8	48	10.5
K3	213/ 71	< 7.2	14.8	8	46	14.8
B3	338/ 47	< 3.9	13.5	6	46	9.0
				Queue empty		
06/2252 ARCHIVE UNIT 1 READ DONE				CONNECTION PENDING DED. RPG LINE 1		

Storm Structure Alphanumeric Product

Hail Detection Algorithm (HDA)

Introduction

The new Hail Detection Algorithm (HDA) has been designed to look for high reflectivities above the freezing level. At the UCP, the operator must provide the algorithm with the 0°C and -20°C altitudes from a representative sounding for accurate hail identification. The algorithm is designed to work independent of the storm type, tilt, and overhang. This is a significant improve-

ment over the Hail algorithm used prior to Build 9.0, which assumed ALL hail storms had super-cell reflectivity characteristics such as: tilt, overhang, and orientation.

The Hail Detection Algorithm outputs the following estimates for each cell detected:

- Probability Of Hail (POH) - identified as hail of any size, displayed in increments of 10%,
- Probability Of Severe Hail (POSH) - identified as hail that is $\geq 3/4$ inch, displayed in increments of 10%, and
- Maximum Expected Hail Size (MEHS) - the estimate of the largest hail size in the cell, computed in increments of 1/4 inch.

If the cell is beyond the hail processing range of 124 nm, then the hail estimates are labeled as UNKNOWN.

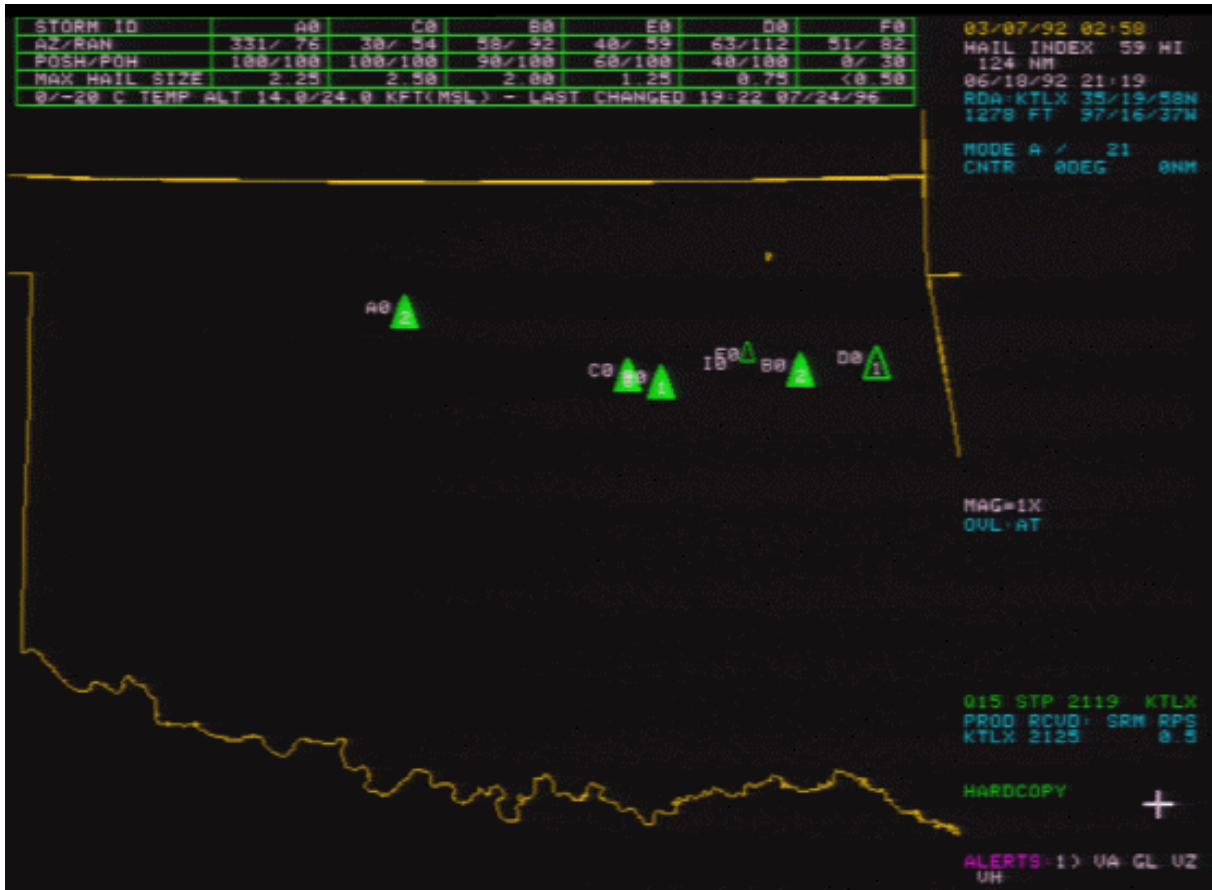
Process

The Hail Detection Algorithm searches for high values of reflectivity above the freezing level. The reflectivities used are the maximum reflectivities of cell components above the freezing level. For the calculation of the POH, the location of the highest reflectivity of at least 45 dBZ above the freezing level is found. The greater the height above the freezing level, the greater the POH. The calculation of POSH and MEHS are more complicated. Reflectivities greater than 40 dBZ (a lower minimum value) above the freezing level are used. In addition, a weighting factor is used, such that the greater the reflectivity above 40 dBZ, and the higher the altitude at which this reflectivity exists, the greater the weighting factor used. Reflectivities greater than 50 dBZ, and higher than the altitude of the -20°C isotherm, carry the most weight. This illustrates the need for users to update the altitude of the 0°C and -20°C levels regularly, especially when significant change to the atmosphere is experienced near the radar coverage area (which is often the case when hail is a concern).

Hail Index Product

The primary product produced by the HDA is the Hail Index (HI - Product ID #59) which can be useful in identifying cells that have the potential to produce hail. The Hail Index graphic product will present several new symbols. The POH will be represented with a small open or solid green triangle the same size as the hail symbol on the old Hail Index product. Whether the triangle is open or solid green depends on a “fill-in” threshold set by the PUP operator for a specific percentage of occurrence. The POSH is represented by a larger green triangle, again with the solid green triangle representing a “fill-in” threshold. The MEHS will be displayed in the center of the POSH symbol rounded to the nearest inch from 1 to 4. If a cell has hail identified that is less than 3/4 inch, then an asterisk (*) will be placed in the center of the POSH symbol.

The Hail Index Attribute Table, color coded in green, will be available at the top of the product which lists the Cell ID, Azimuth and Range, POSH or POH, the MEHS (to the nearest 1/4 inch), and the last line in the table identifies the altitudes of the temperatures and the date/time at which the information was last updated, (1/1/96 12Z is displayed if data has not been entered). Each page of the table can contain up to 6 cells. Cells are ordered first by POSH and then by POH. In



Hail Index Product

addition, the parameters of POH, POSH, and MEHS will be displayed in the Composite Reflectivity Combined Attribute Table and the Hail Index alphanumeric product.

UCP Parameter Selection

At the UCP, the Hail Temperatures/Default Storm Motion Menu has been added under the Environmental Data (E,H), to allow the operator to input the most recent 0°C and -20°C altitudes. These values should be obtained from representative sounding information. If no recent nearby sounding is available, a forecast sounding or interpolation from surrounding soundings is recommended. *This should be done twice daily or as meteorological conditions warrant for the algorithm to provide accurate hail estimates.*

PUP Parameter Selection

At the PUP, the SCIT and HDA Display Parameters Edit Screen (AD,<PASSWORD>,S) has been added to allow the operator to change the percentages of occurrence for the different hail symbol triangles. For the POH and POSH, the Minimum Display Threshold is the lowest percentage for which the open triangle will be displayed, and the symbol fill-in threshold is the lowest

HAIL TEMPERATURES/DEFAULT STORM MOTION

PAGE 1 OF 1

COMMAND: E,H,

FEEDBACK:

OPER A/R 21

(M)odify (E)nd (C)ancel

ITEM	ALTITUDE MSL		DEFAULT STORM MOTION	
	0 DEG C	-20 DEG C	DIRECTION	SPEED
CURRENT	10.0 Kft	20.0 Kft	225 Deg	25 Kts
MIN	0.0	0.0	0	0.0
MAX	70.0	70.0	360	99.9

SCIT AND HDA DISPLAY PARAMETERS EDIT SCREEN

COMMAND: AD,*****,S

FEEDBACK:

Enter the display parameters and press RETURN. Changes take effect immediately.

SCIT Number of cells to display (0 to 100): 20
 Display past positions? (Y or N) : Y
 Display forecast positions? (Y or N) : Y

HDA Probability of Hail
 Minimum display threshold (10% to 100%, or D*): 30 %
 Symbol fill-in threshold (10% to 100%) : 50 %

 Probability of Severe Hail
 Minimum display threshold (10% to 100%, or D*): 30 %
 Symbol fill-in threshold (10% to 100%) : 50 %

*Entering the letter D here will disable the display of this symbol.

percentage for which the solid triangle will be displayed. Changes made to this menu take effect immediately and the results can be seen by re-selecting the Hail Index product or overlay.

Limitations

The Hail Detection algorithm needs as input, accurate and timely measurements of the MSL altitudes for the 0°C and -20°C levels. ***Failure to update this information will degrade the algorithm's performance.***

The maximum hail processing range is 124 nm. The values for POH, POSH, and MEHS may fluctuate at longer ranges from the radar due to the limited number of slices through the cell. Values will also fluctuate at close ranges, especially in VCP 21, due to gaps in coverage. For cells beyond 124 nm, hail will be identified as UNKNOWN. This range is adaptable (OSF level of change authority).

A large number of cells can now be displayed on the hail product and because of this the chances for Narrowband Loadshedding have increased. To reduce the product size and the chance for Narrowband Loadshedding, a parameter which limits the number of storm cells displayed on the HI attribute and alphanumeric product can be changed at the UCP, (SE,<PASSWORD>,CE). This change has to be approved by the local Unit Radar Committee.

In limited operational use, the POSH and MEHS have tended to overestimate the chances and size of hail in weak wind and tropical environments. The accuracy of the hail estimates partially depends upon the accuracy of cell (component) information.

The operator has to keep in mind that the MEHS should only be used as a guide. Storm spotters and other operational means should be integrated into the warning decision.

Strengths / Applications

The Hail Detection Algorithm has shown a very high probability of detection of cells that contain severe hail, especially greater than one inch diameter hail. While false alarms may be a limitation, the display parameters are adaptable at the PUP, and local adjustments to thresholds may reduce false alarms.

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Pages R-26 and Page R-8.
- WSR-88D Operator Handbook, Unit Control Position, Job Sheets, Page 120.

Cell Trends

Introduction

Cell Trends is a new PUP display which provides users with up to a 10 volume scan history of key parameters for any user-selected algorithm-identified storm cell. Cell Trends is not a product, but is a display which is derived “on-the-fly” from information stored with the Storm Structure (SS) alphanumeric product. Cell Trends will assist operators by showing a history of important radar-derived parameters, which will help in the assessment of storm severity and development.

Format

The Cell Trends display consists of four graphs which show up to a 10 volume scan history of the following parameters:

Upper Left: Cell Top, Cell Base, Height of Centroid and Height of Maximum dBZ
Upper Right: Probability of Hail (POH), Probability of Severe Hail (POSH)
Lower Left: Cell-Based VIL
Lower Right: Maximum Reflectivity

The right side of the display (the Status and Annotations area) provides the Cell ID, the AZRAN, a small graphical plot of cell location in relation to the RDA, and a list of volume scan times included in the trend data. Times listed in gray mean the cell did not exist at that time.

Display Definitions

Cell Top/Base are used in reference to the height (ARL) of the highest/lowest cell components. Cell bases or tops which are found on the lowest or highest elevation slices are so indicated on the height line with a “v” or “^”, respectively. Centroid Height is the height (ARL) of the 3-D center of mass of the cell. Maximum Reflectivity Height is the height (beam centerpoint - ARL) of the component in which the highest reflectivity in the cell is detected.

Cell-based VIL is based on reflectivity associated with an identified cell, as opposed to the Grid-based VIL (VIL - Product #57) which is based on reflectivity in grid boxes. Cell-based VIL integrates water computed from the maximum reflectivity of all cell components. Cell-based VIL should provide a more accurate assessment of VIL for fast-moving or strongly-tilted storms strong tilt. For more information on Cell-based VIL, see the preceding section on the SCIT algorithm.

Probability of Hail is defined as the probability of hail of any size, and Probability of Severe Hail is defined as the probability of hail greater than or equal to 3/4 inch. For more discussion on hail, see the next section on Hail Index.

Cell Trend Request

Cell Trends is not a product, it has no product ID # or mnemonic. Cell Trends is a display, much like the NEXRAD UNIT STATUS. This display is generated at the PUP, using data from the Storm Structure product stored in the PUP database.

Since this is not a product, the alphanumeric keyboard cannot be used to display Cell Trends.

Operators wishing to use the Cell Trends display frequently, should add the Storm Structure alphanumeric product (SS) to the current Routine Product Set (RPS). One-Time Requests can also be made for Storm Structure. Once the SS product is received at the PUP, the Cell Trends display can be used. The SS product can be archived, therefore, Cell Trends information CAN be displayed at a later date by retrieving the SS product from archive.

Cell Trends can only be displayed using the CELL TRENDS box on the Graphic Tablet, which is located in the OVERLAYS section, but is colored blue. The operator must click the puck button within 4 km (2.2 nm) of an algorithm identified storm (using any geographic product), then select the CELL TRENDS box for Cell Trends to be displayed.

Limitations

Cell Trend information is dependent on the scanning strategy used to sample the environment. The VCP selected by the operator can have a noticeable impact on the Cell Trends display, especially on the trends which involve the altitude of a parameter. It is even possible that a trend of increasing or decreasing cell intensity may be displayed, when in fact the cell is not changing intensity. These false trends may be due to gaps between elevation tilts.

This display will be most accurate using VCP 11, which has fewer gaps between elevation tilts. Users may notice more variability of the Maximum dBZ Height, Centroid Height, and Altitude of Cell Top and Base using VCP 21 as compared to VCP 11. More discussion on this topic is included in the section above on the SCIT algorithm.

Errors in cell attributes often occur when cells are in close proximity. Trends of cell attributes may be misleading anytime cells are in close proximity.

Cell Trends is dependent on receipt of the Storm Structure product. This product can become large and has increased potential for narrowband loadshedding. The size of this product (number of cells displayed) is controllable at the UCP in the Selection of Product Parameters, Cell Product Parameters edit screen (SE,<PASSWORD>,CE). Note that Cell Trend data will exist for all detected cells regardless of this setting.

Strengths

A large amount of information on an individual cell is displayed on a single easy-to-interpret display. For isolated cells that are greater than 20 nm from the RDA, Cell Trends provides a reasonably accurate view of cell evolution.

An example of a Cell Trends Display is shown below.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-163.



Cell Trends Product

Clutter Filter Control (CFC)

Introduction

The Clutter Filter Control (CFC - Product ID #34) is a new graphics product displaying the current status of clutter suppression invoked at the RDA. Previously, the status of clutter suppression was unknown unless the UCP operator logged which Clutter Suppression Region file was in effect.

At the beginning of every volume scan, the RPG checks the RDA status data to see if it has the latest Bypass and Notch Width maps. If the maps are no longer the current ones being used at the RDA, the RPG requests them from the RDA. In this instance, the new maps are sent to the RPG and all four products are generated (Doppler and Surveillance for both Elevation Segment Numbers). If the operator downloads a Clutter Suppression Regions file, the RDA sends the new Bypass and Notch Width maps back to the RPG for generation. The Clutter Filter Control products are available to both Associated and Non-Associated PUPs.

To ensure that the most recent CFC products are in the database, the PUP operator should make a One-Time Request. Each of the four products have the same Product ID Number of 34, but different parameters. The parameters are differentiated by either the Doppler or Surveillance Channel and an Elevation Segment Number of 1 or 2.

Product Request

One-Time Requests are initiated through the **(D,G,CFC)** menu (Figure 1) at the PUP Applications Terminal. The PUP operator should enter an asterisk (“*”) in the time field to request the most recent CFC products from the RPG. Remember, each of the four products must be requested individually. The Elevation Segment Number of 1 or 2 is entered in the Slice field and the channel should be entered in the PARAM1 field. Entries in the Slice and PARAM1 columns would look like this:

<u>Slice</u>	<u>PARAM1</u>	
1	D	Doppler Channel Suppression for elevation segment number 1
1	S	Surveillance Channel Suppression for elevation segment number 1
2	D	Doppler Channel Suppression for elevation segment number 2
2	S	Surveillance Channel Suppression for elevation segment number 2

DISPLAY GRAPHIC PRODUCT EDIT SCREEN

COMMAND: D,G,CFC

FEEDBACK:

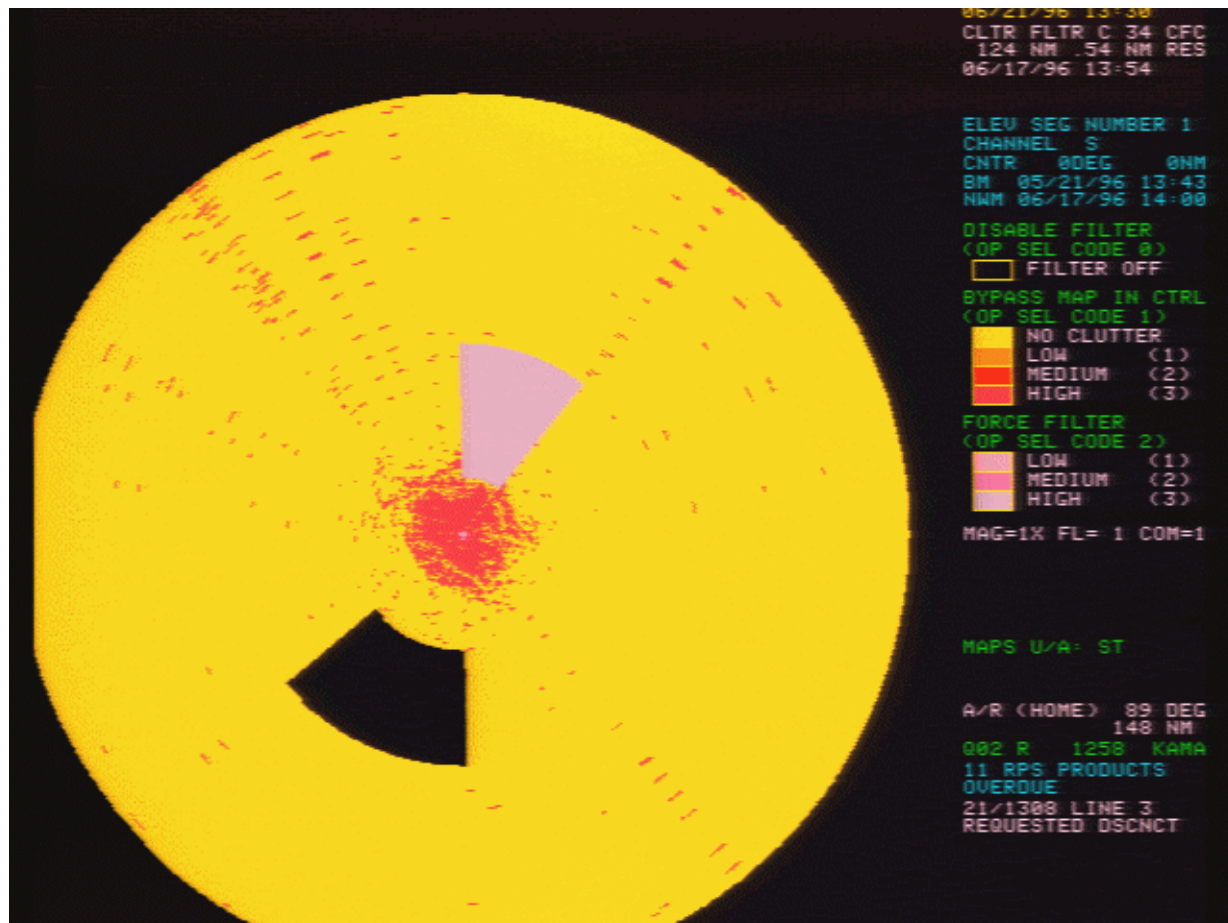
Edit product parameters and press RETURN to request product.

PROD	DTA										REQ	RPT	REQ
<u>NAME</u>	<u>LVL</u>	<u>RES</u>	<u>SLICE</u>	<u>PARAM1</u>	<u>PARAM2</u>	<u>RPG</u>	<u>TIME</u>	<u>DATE</u>	<u>SCR</u>	<u>PRI</u>	<u>CNT</u>	<u>MAP</u>	
CFC	8.54		1	D			*		L	H	1	N	

Since the Clutter Filter Control product is not routinely displayed, there is no selection box on the Graphic Tablet. To display the product, after the request, leave a graphic screen blank or display it through the **(D,G,CFC)** menu at the Applications Terminal. Once the CFC product is displayed on the graphic screen other One-Time Requests may be made via the Pick-a-Product screen.

Once the Clutter Filter Control product is displayed, the usual graphic product manipulation functions (magnify, recenter, filter, blink, etc) may be applied. The products can be displayed with

background maps, in quarter screen mode, and are available for Archive Level IV. CFC products can be annotated, but cannot be time lapsed.



Clutter Filter Control Product

Product Display Information

Referencing the status and annotation area in Figure 2, provides the following information:

- The second line has the product name, the product ID number, and product mnemonic.
- The third line gives the product range, and resolution.
- The seventh line indicates the elevation segment number.
- The eighth line indicates the channel.
- Lines nine and ten indicate the date and time the Bypass and Notch Width maps were last modified or edited.

The next section explains the eight CFC data levels:

- The first data level is operator select code 0. This code disables all filtering.
- The second through fifth data levels are associated with operator select code 1 (Bypass Map in control). The different data levels indicate the amount of suppression invoked.
- The last three data levels, six through eight, relate the amount of forced clutter suppression

(Operator Select Code 2) applied to every 1° by 0.54 nm range bin.

Figure 2 is an example of the defined clutter suppression areas for all elevation slices below two degrees for the Surveillance Channel. (Note, clutter filtering can be invoked out to 248 nm even though this product only displays information within 124 nm.) In this example the yellow and red areas are a result of the Bypass Map. The amount of suppression is a result of the downloaded Clutter Suppression Regions file telling the clutter filters to invoke medium suppression to every 1.4° by 0.54 nm area determined by the Bypass Map. The yellow areas indicate no clutter and therefore no suppression. The dark red areas indicate medium suppression, entered by the UCP operator. The gray area indicates forced suppression for every range bin. This area, entered by the UCP operator, is from 0 to 40 degrees and between 30 and 105 km from the RDA. The area that looks like missing data indicates no clutter suppression. This area was entered by the UCP operator for an arched area from 180 to 230 degrees and between 60 and 115 km from the RDA. Note the priority for clutter suppression is Operator Select Code 2, then 0, and then 1.

IMPORTANT ONE-TIME REQUEST INFORMATION!!

If the RPG has to request the Bypass and Notch Width Mapse from the RDA to generate the CFC products for a user request, it may take a volume scan or two to deliver the products to the RPG. There is a 15 minute time limit on how long the RPG waits for the RDA. If this time expires, the user will have to resubmit the request for the CFC products in order to receive them!

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page R-23.
- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Pages R-22, 2-71, and 2-72.
- WSR-88D Operator Handbook, Unit Control Position, Job Sheets, Pages 7 and 34.

Precipitation Products From Cartesian To Polar Format

Introduction

All graphical precipitation products will be displayed in polar format, with a resolution of 1.1 nm by 1°. Prior to Build 9.0, during product generation the precipitation products went through an additional step of converting the data from 1.1 nm by 1° polar format to 1.1 nm by 1.1 nm Cartesian grid. This step has been eliminated.

Resolution Considerations

Because of the 1° beamwidth, data displayed in polar format will have better resolution than that displayed in a Cartesian grid within about 70 nm. Beyond 70 nm the polar format display has

poorer resolution than the 1.1 nm by 1.1 nm Cartesian grid. The improved resolution of the Cartesian grid beyond 70 nm was not realistic however, because the Cartesian grid was created from data collected in the polar format. The change to polar format will display the data as it is actually collected and processed.

Build 8.0/Build 9.0 Conflicts

During the transition from Build 8.0 to Build 9.0, and especially during the Beta Test, there will be display conflicts between radars with different software builds:

- *Precipitation products generated with Build 9.0 are not displayable on PUPs with Build 8.0 software.*
- *When a PUP with Build 9.0 displays a precipitation product generated with Build 8.0, the product will blink once upon display, then display in the correct format.*
- *A Build 9.0 PUP cannot time lapse precipitation products generated with Build 8.0. and vice versa.*

Reference:

- WSR-88D Users Guide, Principal User Processor, Volume 1, Graphic Tablet, Pages R-27, R-30, R-31, and R-32.

Supplemental Precipitation Data (SPD)

Introduction

The Supplemental Precipitation Data (SPD - Product ID #82) is a new PUP displayable alphanumeric product. It contains information on the rain gage bias, isolated bins and outliers tests, tilt test, and bi-scan maximization.

Product Display and Format

The SPD is only displayable via the Display Menu at the PUP Applications Terminal. It can be received at the PUP like any product, as a One-Time Request, an RPS list product, or an alert paired product. Page 1 of the SPD contains rain gage bias information, and the number of isolated range bins and outliers that are corrected. Also listed are the percent reduction of echo area in going from 0.5° to 1.5° in the tilt test. The Bi-Scan Ratio, also listed, is from the Bi-Scan Maximization, which is part of the hybrid scan construction. For the range interval where Bi-Scan Maximization is performed, this is the ratio of 1.5° bins chosen over 0.5° bins. For example, a Bi-Scan Ratio of .25 means that 25% of bins had high reflectivities at 1.5°, and thus were chosen. Periods of missing data are listed at the bottom of the page.

Subsequent pages will contain rain gage-radar pair information and rainfall accumulations when the Gage Data Support System is implemented.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Pages R-29 and 2-67.

```

      ALPHA PRODUCT 82 (SPD KLWX 19:36 06/27/95) PAGE 1 OF 2
COMMAND: D,A,SPD
FEEDBACK:

SUPPLEMENTAL PRECIPITATION DATA - RDA ID 3 06/27/95 19:36
VOLUME COVERAGE PATTERN = 21 MODE = A TIME CONT: PASSED

  GAGE BIAS APPLIED - NO
    BIAS ESTIMATE - 1.00
    VARIANCE - 0.50000

  NUMBER OF ISOLATED BINS - 212
    INTERPOLATED OUTLIERS - 0
    REPLACED OUTLIERS - 0
    HOURLY OUTLIERS - 0

  AREA REDUCTION (PERCENT) - 24.32
  BI-SCAN RATIO (RATIO) - 0.43

MISSING PERIOD: 06/27/95 19:12 06/27/95 19:23

Q10 SPD KLWX 1855
27/1932 PROD STAT= AVAILABLE PROD RCVD: THP RPS KLWX 1942

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Supplemental Precipitation Data Product**User Selectable Precipitation****Introduction**

The User Selectable Precipitation (USP - Product ID #31) is a graphics product displaying the precipitation accumulation for a user-specified period of time. Previously, precipitation accumulations for durations longer than 3 hours were only available via the Storm Total Precipitation (STP) product. One of the limitations of the STP is that it may not cover the desired time period, especially for long-lived precipitation events. The USP will allow the Associated PUP (APUP) operator to overcome this limitation by specifying the time period for the precipitation accumulation. A default USP is generated and made available to Non-Associated PUPs (NAPUPs) for the 24-hour period ending at 1200 UTC, and will remain stored in the RPG database until the next 12Z 24 hour product is generated.

Product Request

The USP is a customized product generated for a specific time period by entering the duration (up to 24 hours). The end hour must be within 23 hours of the current time. It is generated from a 30-hour database of hourly accumulations ending at the top of the hour. A duration must be specified, but if the end time parameter is left blank the end time defaults to the latest available hour.

The USP may be generated by a One-Time Request, or may be placed on the RPS list to be generated every volume scan. Placing the USP on the RPS list and leaving the end time parameter blank will provide the APUP with a moving window of precipitation accumulations for the specified duration. If the USP is placed on the RPS list, a product will be sent every volume scan, even though the product data is updated at the top of the hour.

Parameter Selection

Two parameter selections have been changed at the Graphic Tablet to accommodate the USP. When entering parameters to display or request from the Graphic Tablet, the end time of the USP is specified by selecting the END HOUR parameter box. If no end time is specified, the product defaults to the top of the current hour. Duration is specified by selecting the SLICE/DURATION parameter box. The SLICE/DURATION parameter box has three functions: It is used to select the elevation angle when entering parameters for an elevation product, the altitude for the VAD products, and the time duration for the USP.

When displaying or requesting the USP through the Display Menu at the Applications Terminal, duration is entered under the slice column, and end time is entered as parameter 1 (PARAM1).

Availability for Non Associated PUPs

In addition to the default USP for the 24-hour period ending at 1200 UTC, any USP that is generated for an APUP is available for One-Time Request by a NAPUP. If the NAPUP operator knows the duration and end time of the USP that is already generated, he/she can request and receive it. It may be advantageous to NAPUPs, such as NWS River Forecast Centers, to coordinate through the Unit Radar Committee the routine generation of the USP for other time periods besides the default. This can be done by placing the additional USP product on the RPGOP RPS list.

Limitations

At least two thirds of the specified hourly accumulations must be available in order to create the product. Unavailable data may be a result of a request for accumulations beyond 30 hours old, missing data due to a radar outage, or bad scans identified by the precipitation algorithms. Zero accumulations (no rain) are valid data and are not considered missing.

Because the USP is a customized product, only 10 unique USP requests will be satisfied per volume scan. This is the combination of USP requests on the Generation and Distribution Control Menu, One-Time Requests, and RPS lists.

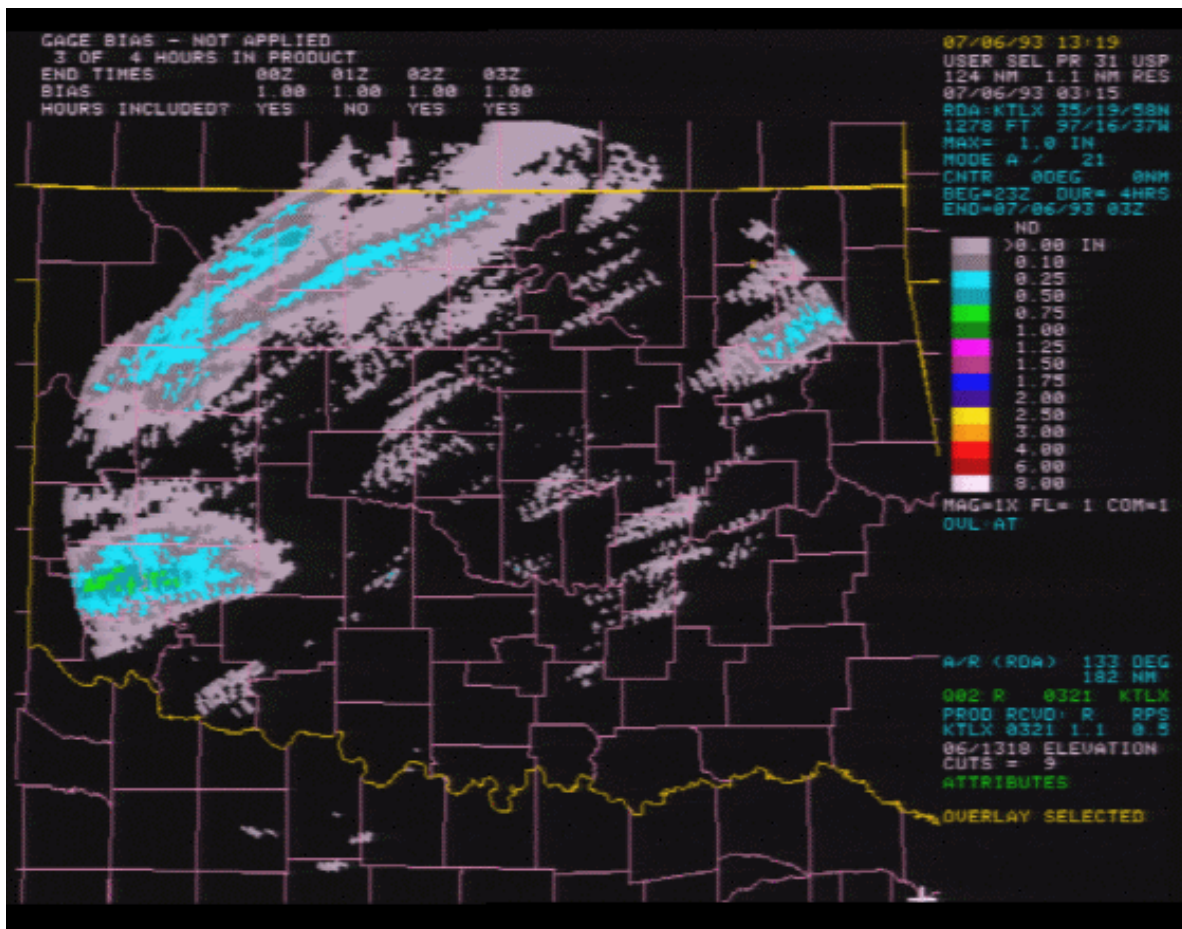
Format

An Attributes Table at the top of the product lists the contributing hours in the USP and the application of the rain gage bias. If there is an insufficient amount of accumulations, the product is blank, and the table lists the accumulations that are available.

New for all Build 9.0 graphical precipitation products, including the USP, is the display of data in polar format with a resolution of 1.1 nm by 1°. Data are displayed in 16 data levels. Data levels are adjustable, based on the values selected for the other graphical precipitation products. For precipitation accumulations at or below the data level values defined for the One Hour Precipitation (OHP) and Three Hour Precipitation (THP), those data levels are used. If precipitation accumulations are greater than the data level values defined for the OHP and THP, then the STP data levels are used.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet: Pages R-21, R-32, and 1-36.



User Selectable Precipitation Product

Radar Coded Message

Introduction

Part A of the Radar Coded Message (RCM) will be generated using data from both the Digital Hybrid Reflectivity and Composite Reflectivity. This is expected to improve the RCM by reducing anomalous propagation and non-precipitation echoes.

Until Build 9.0, the RCM was derived from the Composite Reflectivity product alone. The Composite Reflectivity product may contain anomalous propagation (AP) returns, as well as echoes aloft which are not producing measurable precipitation at the surface. As a result, the RCM product also suffered from AP and non-precipitation echoes.

Digital Hybrid Reflectivity

The new Digital Hybrid Scan Reflectivity (DHR) product available in Build 9.0 will be used to build the RCM product within 124 nm of the RDA. The DHR product is not directly displayable at the PUP, and is the resulting reflectivity obtained from the hybrid scan construction step in the PPS pre-processing algorithm. Recall that the hybrid scan construction attempts to present reflectivity data at a constant altitude of approximately 3000 feet AGL by utilizing information from the four lowest tilts. Data for 1-11 nm from the RDA uses reflectivity from the 3.4° tilt, data for 11-19 nm uses the 2.4° tilt, data for 19-27 nm uses the 1.5° tilt, and data for 27-124 nm uses the reflectivity from either the 0.5° or the 1.5° tilts depending on where bi-scan maximization is involved (see page 43). Additional quality control checks on the reflectivity data (beyond those performed at the RDA) are executed before the hybrid scan product is generated, including a check for isolated reflectivity, reflectivity outliers, and a tilt test for vertical height continuity of returns.

The result of using the DHR product within 124 nm of the RDA will be to provide a more accurate and realistic display of reflectivity in Part A of the RCM product. Beyond 124 nm of the RDA, Composite Reflectivity is used in the RCM.

Cell Data

Information on up to 20 cells (default 12) are included in the RCM, with the ranking the same as the Composite Reflectivity Combined Attribute Table (See page 6).

Hail Terminology

The old hail algorithm terminology “possible”, “probable”, etc. values are still being displayed in the RCM. These labels are now based on POSH (See Hail Detection Algorithm), and set in the HDA adaptation data (default is 10% for probable and 50% for positive).

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page R-28.
- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page R-27.

ENHANCED DISPLAY FUNCTIONS

Default Setting For Map Foreground / Background

Introduction

This function will establish the default foreground / background map setting. It is a toggle, and once the operator chooses a setting, it will remain in that condition until changed by the operator.

Operator Benefits

Currently, this function always reverts to a BACKGROUND setting when a new product is displayed, forcing operators to manually select FOREGROUND. Users often wrote a user function to perform this action in all quadrants of a quarter screen display, which will no longer be necessary. In addition, the setting will now always default to FOREGROUND after a PUPUP, a graphics reset, or a software restart.

Reference:

- WSR-88D Operators Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-171.

Last Product Remembered For Redisplay In Quad Mode

The PUP will now remember which product was last displayed in each of the four quadrants of a quarter screen display. In addition, this function will work with the ALL QUADRANTS function, allowing the user to pull up the last product in all four quadrants simultaneously. Prior to Build 9.0, when REDISPLAY LAST PRODUCT was selected, the software would display the last product which was displayed in ANY of the four quadrants, not necessarily from the active quadrant.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-26.

All Quadrant Function

Introduction

The ALL/ONE QUAD toggle function on the PUP Graphic Tablet will be replaced with a new function called ALL QUADRANTS. This new function is compatible with 53 boxes on the Graphic Tablet, allowing these selections to affect all quadrants of a four panel display. The ALL QUADRANTS function is not a toggle; the next Graphic Tablet function selected after choosing ALL QUADRANTS will affect all panels of a quarter screen display. The Graphic Tablet function will then revert back to affect only the active quadrant unless the ALL QUADRANTS function is selected again.

			RECENTER MAG 1X	RECENTER MAG 2X
			RECENTER MAG 4X	RECENTER MAG 8X
CLEAR SCREEN/ QUAD	FILTER	COMBINE DOWN	COMBINE UP	
BLINK COLOR LEVEL	RESTORE DISPLAYED PRODUCT	GRAY/ COLOR SCALE		
ALL QUADRANTS		PRESET CENTER		
			CURRENT CROSS SECTION CR	ANNO'S AN
HAIL H	MESO M	TVS TV	STORM TRACK ST	
ALERT AREA 1 A1	ALERT AREA 2 A2	SWP A2		COMBINED SHEAR CONTOUR SC
OVERLAYS ON/OFF	OVERLAYS ERASE	MAP OVERLAY DELETE	STOP BLINK	
		PRODUCT OFF/ON	MAPS OFF/ON	MAPS ERASE
			MAPS FOREGD/ BACKGD	
PRODUCT BACK	PRODUCT FORWARD		STATE LAT/LON ST	COUNTY CO
			HIGHWAY HY	RADAR SITES RS
		REDISPLAY LAST PRODUCT	RIVER RV	RIVER BASIN RB
			RDA	RANGE RING
			WARNNG AREA WA	MIL OPN AREA MO
			POLAR GRID	LFM GRID
			RSTRCTD AREA RA	PRHBD AREA PA
			AIRWAY HIGH AH	CITY CI
			NAVAID NA	AIRPORT AP
			AIRWAY LOW AL	COUNTY NAMES CN

Operator Benefit

The ALL QUADRANTS function will help operators by reducing the time spent on performing certain tasks. For example, it takes eight steps to place the Storm Track Information overlay on

top of each product in a quarter screen display. The operator must first select the quadrant, then select the STI overlay, and repeat this procedure four times. The ALL QUADRANTS function will simplify this procedure, and the operator can now select ALL QUADRANTS, then the STI overlay box, and the Storm Track Information overlay will appear in all four quadrants of the display.

Impact on User Functions

The change in functionality from ALL/ONE QUAD (Build 8.0) to ALL QUADRANTS (Build 9.0) will have significant impacts on user function definitions. *Sites are urged to examine each user function and determine if modifications need to be made, since ALL QUADRANTS is NO LONGER a toggle function.* It is also possible that some user functions will no longer be needed. For example, a user function to perform a PRODUCT FORWARD in each quadrant of a four panel display is now easily done manually with ALL QUADRANTS.

The above illustration shows which Graphic Tablet selections are valid with the ALL QUADRANTS function. All boxes in the illustration that are labeled (53 total) can be used in conjunction with ALL QUADRANTS.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Pages R-36 and R-37.

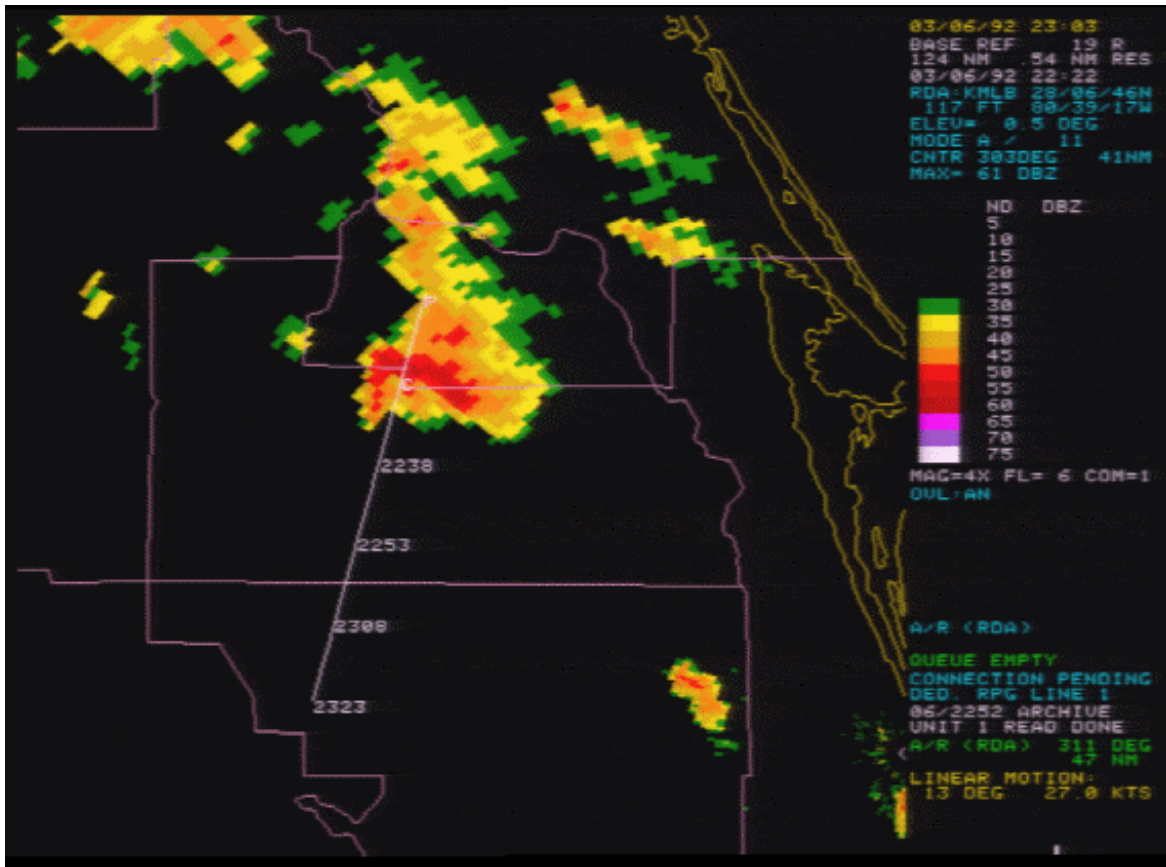
Linear Motion Estimates Labeled In Clock Times

Linear Motion Estimates will be labeled in real clock times in the format **hhmm**. This will help operators determine the future position of the selected feature by giving the actual time the feature will arrive at each projected location, rather than labels of 15, 30, 45 and 60 minutes as before. This should eliminate the confusion operators sometimes had when the Linear Motion Estimate was displayed on the older of the two chosen volume scans. The procedure to produce the Linear Motion Estimate calculation at the PUP has not changed, only the labels next to each forecast position.

The estimate is only as good as the operator selected points. The date is not shown at each forecast position, and is assumed to be the date of the product which is being displayed. For estimates which cross over midnight, the assumed date is the next day. An example of the new display format is shown below.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-166.



Linear Motion Estimates Labeled In Clock Times

VR/Shear Function Modified

Introduction

The VR/Shear function was added in Build 8.0 to allow operators to quickly assess

rotational velocity and shear of a storm-scale circulation. The endpoints chosen by the operator were stored as screen coordinates. The points selected for VR/Shear calculations are now saved to memory as geographic positions, and not screen coordinates.

Operator Impact

Saving the selected points as screen coordinates in Build 8.0 caused unexpected results when a user would request a VR/Shear calculation on one screen, then make the same request on another screen which had a different magnification, or a different product resolution. The operator expected the system to use the same geographic points on the magnified products.

In Build 9.0, the operator will be able to use previous point selections for subsequent VR/Shear requests. As long as the operator does not select another location with the puck, products may be

continually displayed, and VR/Shear calculations will be performed at the same geographic location. The actual process of selecting points and displaying VR/Shear information has not changed.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-164.

VR/Shear Function In Time Lapses

Introduction

The VR/Shear function allows operators to quickly assess the rotational velocity and shear of a storm-scale circulation. This operation is most often performed on a Base Velocity or Storm Relative Mean Radial Velocity Product. However, if the velocity product was displayed via a Time Lapse, the results were not reliable. Because of the way in which time lapses were created and stored at the PUP, *the function only worked with every other time lapse image*, although output was given for each and every image. In addition, the function did not work at all if a low resolution time lapse image was displayed. For Build 9.0, the function will now operate on each image in a high resolution Time Lapse Display. Because of a decrease in the reliability of the output, it is disallowed if a low resolution image is displayed.

Operator Impact

The operator can display a V or SRM time lapse (at an update speed of 1 frame/second or *slower*) and then select TIME LAPSE RES/HLT in order to pause the loop. The operator may then perform the VR/SHEAR function on each frame (using FRAME FORWARD or FRAME BACK) of the velocity loop. We recommend that this function be used with the *highest magnification possible* for the displayed product.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-164.

Capability To Re-center Polar Grid

Introduction

The operator will now be able to center the polar grid at any cursor location. This function will give operators another method of determining the azimuth and range of significant meteorological features relative to any specified location. This feature also works with time lapse and magnification of products.

Operator Actions

When the polar grid is centered at the RDA, the grid color will be white. When the operator centers the polar grid at some location other than the RDA, the grid color, as well as the polar grid message, will be the same color as the state borders that have been defined. If adaptation data colors for any maps are changed, it may affect the color of the polar grid. Operators should select product and the proper center point and product magnification BEFORE re-locating the polar grid. If a new polar grid location has been defined and a change in product magnification or recenter is requested, the polar grid will be placed back at the RDA in white. Operator actions to re-locate the center of the polar grid are:

1. Select Polar Grid (Displays grid at RDA)
2. Select Map Overlay Delete
3. Select Polar Grid (Deletes grid at RDA)
4. Choose new center location with the puck
5. Select Polar Grid (Displays grid at user specified location)

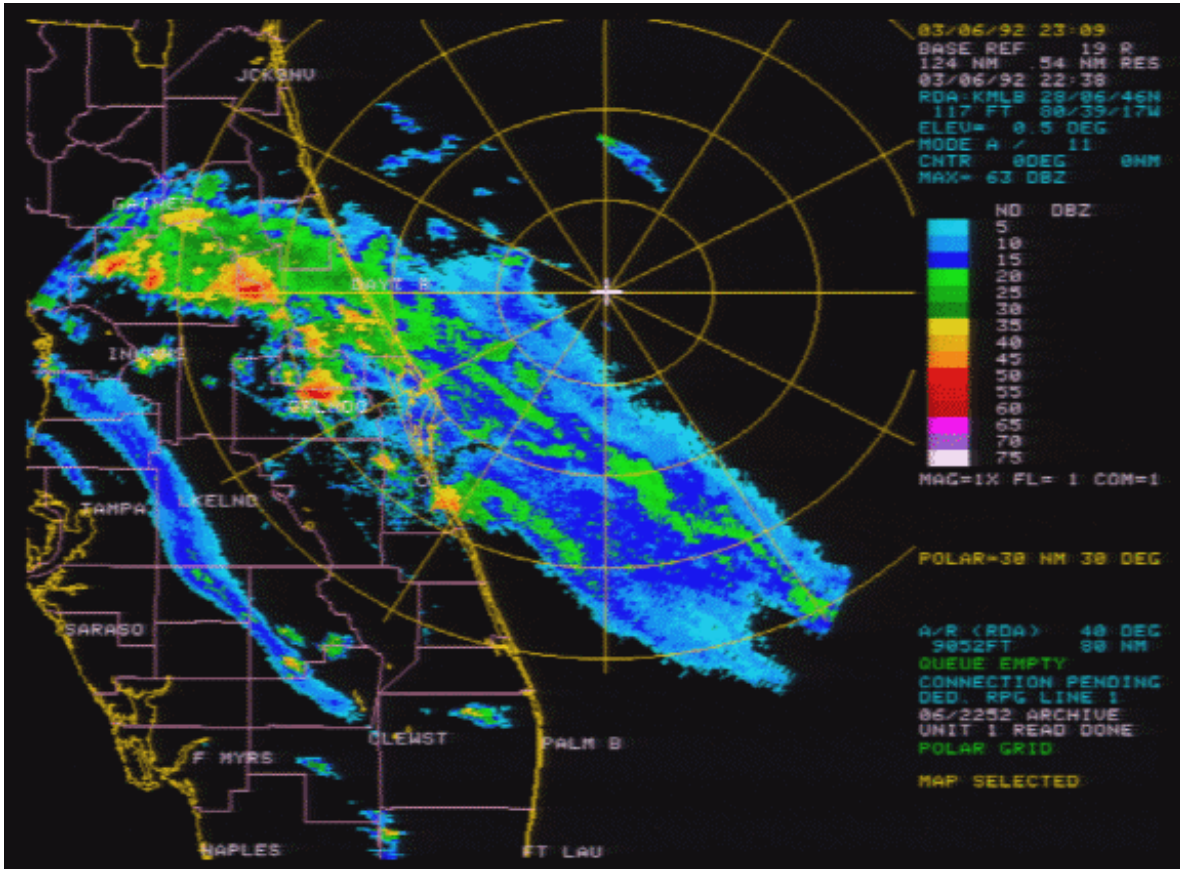
Alternately, the operator could follow these steps:

1. Choose new center location with the puck
2. Select Polar Grid (Displays grid at RDA)
3. Select Map Overlay Delete
4. Select Polar Grid twice (Deletes grid at RDA, then displays grid at user specified location)

Note that whenever background maps are re-drawn, the polar grid will default back to the radar location. An example of a user specified center for the polar grid is shown below.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-158.



Capability To Re-center Polar Grid

Hardcopy Feedback Message

The PUP message **“Hardcopy Request Accepted”** will no longer be displayed on the feedback line of the PUP graphics monitors after a hardcopy has been requested. This reduces the problem of the operator being unable to generate a hardcopy of VR/Shear and Linear Motion calculations, which appear on this feedback line and are overwritten during the print process.

Although this problem has been eliminated to a large extent, operators should be aware that *only the specific message “Hardcopy Request Accepted”* has been programmed not to appear on the feedback line. Other feedback messages (those indicating a negative outcome to the request) will still appear. For example, if Linear Motion Estimate information appears on the feedback line, and a hardcopy is requested while the printer is processing another print request, the message **“Hardcopy Busy”** *will still appear* on the feedback line, overwriting the data.

Increase In Number Of Auxiliary Map Files

Introduction

The PUP will have the capacity of storing 21 complete map sets, meaning 20 auxiliary map sets can be stored in addition to the maps from the user's Associated RPG.

Operator Benefit

This change will reduce the need to request background maps from Non-Associated RPGs during One-Time Requests, with a significant savings in product transmission time. Additionally, background maps transmitted from a Non-Associated RPG during a One-Time Request are only a subset of all the maps available. Adaptation data at the remote RPG determines which map files are transmitted with each product.

Display / Archive

A new display screen is available at the PUP to indicate which map sets are available. The PUP command (**S,B**) (Status, Background Maps) will list the 21 map sets, with Map #1 being the location for the Associated RPG maps. (In the current software, the (**S,B**) command displays the four available map sets on the feedback line.) The partial archive commands (**A,A,B,<FILENAME>**) and (**A,R,B,<RPG>**) also utilize this display screen. Although 21 map sets can be stored on the PUP's hard drive, the automatic archive of the background map files function records to optical disk only the first four background map files. The operator can manually select any map for archive using the command (**A,A,B <file number>**).

An example of the PUP display screen for Status, Background Maps is shown below.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page 2-56.

```

                                BACKGROUND MAP FILES
COMMAND:  S,B
FEEDBACK:

      MAP#      RPG              MAP#      RPG              MAP#      RPG
      ---      ---              ---      ---              ---      ---
       1*      KLWX              11       *****              21       *****
       2       KMPX              12       *****
       3       KMLB              13       *****
       4       KDDC              14       *****
       5       KEAX              15       *****
       6       KLOT              16       *****
       7       KJAN              17       *****
       8       *****           18       *****
       9       KLSX              19       *****
      10       KCYS              20       *****

*Footnote:  Map#1 is the Associated RPG Map.

06/2252 ARCHIVE UNIT 1 READ DONE      Queue empty
                                         CONNECTION PENDING DED. RPG LINE 1

```

Increase In Number Of Auxiliary Map Files

Two User Functions May Operate At The Same Time

Introduction

PUP software now allows the capability to execute two user functions simultaneously.

Previous software forced the operator to cancel the current user function before a second one was invoked.

Operator Benefit

This improvement will benefit operators by allowing one user function to operate in the “back-ground”, while invoking a second user function. For example, during severe weather situations it is often desirable to have a user function dial to a Non-Associated RPG to request products, wait a short period of time, and have the user function call itself. Unfortunately, this has meant the operator has had to cancel the first user function in order to invoke another to investigate storm structure. This problem is now solved.

Operator Impact

To support this software change, currently active user functions are now displayed in the upper left corner of all menus at the PUP Applications Terminal. The example below indicates that user functions 8 and 9 (**UF8 UF9**) are now active. Operators should be aware that user functions cannot be canceled individually. If two user functions are active, and “Cancel User Function” is selected either from the Graphic Tablet, or the Applications Terminal, both will be canceled. Another consideration involves being aware of the contents of user functions with regard to display screens. Two user functions operating simultaneously, both of which display products on the left *and* right screens, will lead to unpredictable results.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page 2-172.

```

UF8 UF9                                MAIN MENU
COMMAND:
FEEDBACK: D,G,R                        L1

Enter command and press return.  For assistance, press the HELP button (F5).

(C)ONTROL
(S)TATUS
(D)ISPLAY
(R)OUTLINE PRODUCT SET
(G)EN AND DISTRIBUTE PRODUCTS
(T)IME LAPSE
(A)RCHIVE
(U)SER FUNCTION
(AD)APTATION DATA
(M)ONITOR PERFORMANCE
(H)ELP

06/2252 ARCHIVE UNIT 1 READ DONE      Queue empty
                                         CONNECTION PENDING DED. RPG LINE 1
  
```

Two User Functions May Operate At The Same Time

Cursor Readout From NARPGs

The operator will be able to define a cursor home position on products from Non-Associated RPGs, providing cursor readouts from a point other than the RDA for dialout products.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-128.

ARCHIVE

OPTREAD Utility

Introduction

The OPTREAD program is a utility used to determine what products, status messages, and maps are stored on the Archive Level IV and Archive Level III optical disk. This program is only compatible with optical disks created with software builds 6.1 or later. ***OPTREAD is run from the PUP's System Console*** with the applications software either up or down. ***The OPTREAD program will not run if any archive function is active.***

To start the OPTREAD program, load an optical disk, type **OPTREAD**, and press **RETURN**.

The OPTREAD Utility's Main Menu and the seven top-level commands.

```
O:      O P T R E A D           Version 4.2
O:
O:      SELECT A NUMBER:
O:
O:      (1)    LIST PRODUCT FILE NUMBERS, DATES AND TIMES
O:      (2)    LIST PRODUCTS IN A FILE
O:      (3)    LIST THE RPGS FOR WHICH MAPS ARE STORED
O:      (4)    LIST THE MAPS AVAILABLE FOR A SPECIFIC RPG
O:      (5)    SEARCH FOR A SPECIFIC PRODUCT
O:      (6)    SEARCH FOR DATA GAPS
O:      (0)    EXIT PROGRAM
```

CAUTION:*Do not remove the optical disk from the drive until executing option 0.*

Main Menu Options

Command 1 displays the volume name of the optical disk and all product files on the disk. It may take one or two minutes to display the file while the optical disk is mounting on. Product files are numbered from 1 to 500 with file number 1 containing data archived first to disk, file number 2 is the second group, etc. If more than one page is displayed, you are prompted to continue. Each product file number lists the date and time of the earliest and latest product or status message. Note that files are listed in chronological order and not in numerical order. The header displays whether the disk is Archive Level III or Archive Level IV and how many data blocks are available for storage on the current side.

Command 2 displays a second level menu prompting you to select either option A or B.

```

O: SELECT A LETTER
O:
O: (A)  LIST THE PRODUCTS IN ONE FILE
O: (B)  LIST THE PRODUCTS IN A RANGE OF FILES

```

Option A, displays, **“Select a file number to examine.”** The file numbers are found through the Main Menu option 1. The contents of the file are sent to the screen, one page at a time. Remember that some products have a graphic portion and a paired alphanumeric portion. A product with a lower case “a” next to it indicates a paired-alphanumeric product. A product listed with an asterisk “*” next to it indicates an annotation for that product. Annotations are stored separate from their associated product.

Option B displays, **“Select a range of files to examine separated by a comma.”** The contents of the selected files are then displayed to the screen in a continuous stream of data. To stop the screen from scrolling use the (<ctrl> S) command and to restart the scrolling use the (<ctrl> Q) command. As in option A, a product with a lower case letter indicates a paired-alphanumeric product and a product with an asterisk “*” indicates an annotation for the product.

Command 3 lists the mnemonic of each RPG with archive maps stored on the optical disk. *Note that this option must be selected with option 4.* If a complete map set is found for a particular RPG, the phrase “Auxiliary Map Set” is displayed next to the RPG mnemonic. Note that you can read these maps into the PUP’s database as auxiliary maps (S,B).

Command 4 lists the background maps available from a specific RPG. It prompts you to enter the four character RPG mnemonic and then lists the map types found for that RPG. *Note for this option to work, menu option 3 must be selected first.*

Command 5 searches the optical disk for a specific product. You are prompted to enter: product name, data levels, resolution, time, and date. The program searches the entire side of the optical disk for the specific product file numbers that contain the product. If the specified product is found, all file numbers containing that product are listed. The system console displays “Product found in file # ***.” Where *** is the product file number.

Command 6 searches the optical disk for data gaps. *This function only works on an Archive Level III optical disk.* You are prompted to input a filename and the current side of the optical disk is searched for data gaps longer than 14 minutes. If a gap is found, a message is generated on the screen. This search may take up to five minutes.

Command 0 (Zero), stops the OPTREAD program and unmounts the optical disk. *Do not attempt to remove the optical disk without first executing this menu option.*

If a problem occurs with the OPTREAD program and you cannot terminate it with menu option 0, you must cancel the OPTREAD program. At the System Console, press the <BREAK> key to display the asterisk. At the asterisk, type CA O and press RETURN. The system’s response should be **END OF TASK 255**.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume III, System Console, Page 3-47.

Archive Check With PUPDOWN Command

Introduction

The PUPDOWN command performed at the System Console will now check the status of Archive Level IV before PUPDOWN begins. If the archive is active, the message “***CANCEL ARCHIVE BEFORE BRINGING PUP DOWN***” is displayed.

Operator Benefit

Performing a PUPDOWN operation while reading or writing to the optical disk often results in corruption of the disk, leading to data loss and increased operating costs. The addition of this check will help reduce potential corruption of optical disk data.

With each archive command, the PUP software will automatically check the integrity of the optical disk directories and indices. If a problem is found and the disk is not write protected, the software will attempt to correct the problem. Operators may need to issue a MOUNTOFF at the System Console if an error occurs.

Limitations

The system checks if the archive task is active. However, archiving will not automatically be canceled. Users attempting a PUPDOWN, and receiving the new message, must manually cancel archive, then attempt to bring the PUP down again.

Operators using the PWRFAIL command will not benefit from this change in Build 9.0. Although the PWRFAIL command performs a PUPDOWN, followed by a PUPUP, operators should be aware that Archive Level IV is NOT checked when the PWRFAIL command is invoked. ***Operators are urged to NOT use the PWRFAIL command.***

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume III, System Console, Page 3-25.

Auto Archive Recovers After Power Failure

Introduction

Previously when power was interrupted at the PUP, the system upon recovery would default back to the AUTO ARCHIVE NOT ACTIVE state. The operator would have to restart any Auto Archive function that had been running. Now when there is a power failure, the PUP upon recovery will restart the last AUTO ARCHIVE function operating at the time of power failure.

Operator Impact

The operator who activates AUTO ARCHIVE (via **A,A,A,I,I** or **N**) will find the same function running after an unplanned power failure.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Pages 2-140 and 2-142.

For Additional Improvements to Archive III and IV Functionality see “Appendix C” on page 54.

ALERTS

New Alerts

As a result of the new SCIT and HDA algorithms, six new Alert Categories have replaced six obsolete Alert Categories, and one alert mnemonic has changed. The table below summarizes the differences in alerting between Build 8.0 and Build 9.0.

Volume Group	Forecast Group
<u>New Alerts</u>	<u>New Alerts</u>
VH - Probability of Hail (8)	FH - Probability of Hail (25)
VA - Probability of Severe Hail (12)	FA - Probability of Severe Hail (29)
VZ - Maximum Expected Hail Size (13)	FZ - Maximum Expected Hail Size (30)
<u>Old Alerts</u>	<u>Old Alerts</u>
VH - Hail (8)	FH - Hail (25)
VV - Maximum Storm Velocity (12)	FV - Maximum Storm Velocity (29)
VD - Storm Volume (13)	FD - Storm Volume (30)

The numbers in parentheses refer to the alert category code for each alert. In addition, the mnemonic for the VAD display (7) has changed from VA to VD, to accommodate the new alert for Probability of Severe Hail.

Also, the alert threshold and exceeding value for the **VP - Max 1 Hr Precip (15)** has been changed to display with a resolution of 0.1 inches.

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Pages R-39 and R-40.
- WSR-88D Operator Handbook, Unit Control Position, UCP-1, Pages 27 and 63.

Volume Scan Time On Status Of Alerts Display

Introduction

A date-time column has been added to this status screen so operators will know when an alert was generated.

Operator Impact

Prior to Build 9.0, a PUP operator requesting the status of alerts with the (S,AL) command had no idea when the alert was triggered. Users had to make an additional check into the system status log using the (S,S) command in order to find out the time the alert was generated. The date/time column added for Build 9.0 will save time and prevent misinterpretation by showing all pertinent alert information on one screen.

As a reminder, keep in mind that a valid alert indicates the threshold has been met somewhere in the alert area. For alert messages generated in previous volume scans, the original alerting feature listed on this screen may or may not still exist. However, the alert condition will remain valid (and listed on the screen) until a volume scan in which all features fall below the threshold has passed. A sample Alert Status display screen is shown below. Note the additional column to the far left.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page 2-58.

Page 1 of 1

COMMAND:
FEEDBACK: EXECUTED - S,AL

↓

ALERT STATUS										
VOLUME	DA/TIME	AA#/GRP	CATEGORY	THR CODE	THR VALUE	THR EXCEED	AZ	RAN	STORM ID	ACK
1	18/2137	1/VOL	MESO	3	MESO	MESO	328	68	M0	N
2	18/2137	1/VOL	PRB SV HAIL	3	30 %	100	329	68	M0	N
3	18/2137	1/GRI	VIL	3	45 kg/m2	80	325	68		N
4	18/2137	1/VOL	MX HAIL SIZ	3	0.75 in	2.50	60	91	B0	N
5	18/2137	1/VOL	PROB HAIL	3	30 %	100	329	68	M0	N

ALERTS 1) VA GL VZ VH

07/0225 VM ALERT AA#1 CANCELLED Q10 HI KTLX 2113
PROD RCVD: R RPS KTLX 2125 1.1 0.5

Volume Scan Time On Status Of Alerts Display

Audible Alarm For Receipt Of Free Text Message

Introduction

This change will ensure that the PUP operator is alerted to the arrival of this product. Previously, the only way an operator would know if a Free Text Message (FTM) arrived would be to observe the Product Received Line at either the PUP Graphics Monitor or the Applications Terminal at the instant the message was received. Often, the receipt of this message would go unnoticed, and the operator would miss potentially vital information from the UCP operator.

Operator Actions

The audible alarm can be acknowledged using either the Graphic Tablet, or the F16 key at the Applications Terminal. There are two types of audible alarms, one for TVS and Mesocyclones, and another for everything else, including FTMs. Operators should keep this in mind in case severe weather alerts and FTMs arrive at the PUP at about the same time.

References:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-114.
- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page 2-58.
- WSR-88D Operator Handbook, Unit Control Position, UCP-1, Pages 19 and 182.

TVS/MESO User Alert Messages

Introduction

The User Alert Message (UAM) is an alphanumeric product which is sent to the PUP each volume scan (once the alert process is activated). For a TVS or MESO alert, the information provided next to the "Threshold" and "Exceeding Value" was listed in numeric format. The operator might then have to look up the "Threshold Values" screen (**AD,A,T**) in order to decipher the meaning of the number. The "Threshold" and "Exceeding Value" entries are now listed in plain English.

Operator Impact

There is no change to operational procedures required with this feature.

Other Enhancements

UCP Precipitation Detection Status Screen Changed

Introduction

The Precipitation Detection Status Screen at the UCP contains information relating to the Precipitation Detection Function. The screen was introduced with Build 8.0, and page 1 has been enhanced in Build 9.0.

Changes to page 1

The format of page 1 was simplified to make it easier to interpret, and the time left in category 1 countdown clock now displays the time until either category 0 or 2 are assigned. Prior to Build 9.0, the countdown clock only counted down the time until category 0 was assigned.

Display description

The first line of page 1 lists the currently assigned precipitation category. If the assigned precipitation category is 0 or 2, any VCP may be invoked. If the assigned category is 1, only a precipitation mode VCP may be selected.

The next line displays the threshold information pertaining to the category currently being *detected*. The detected area can be compared to the threshold area to determine an appropriate setting for the nominal clutter area. The last entry of this line is the category that is currently *detected*. Note that the *detected* category may not be the same as the *assigned* precipitation category found on line 1.

The final three lines contain information on when precipitation categories 1 and 2 were last detected. If category 1 is assigned, but no longer detected, the "TIME LEFT IN CAT 1" countdown clock indicates when category 0 or 2 will be assigned. When the timer counts down to zero, a switch to a Clear Air Mode VCP will be allowed.

There were no changes to page 2 or 3 of the Precipitation Status Screen.

Reference:

- WSR-88D Operator Handbook, Unit Control Position, Job Sheets, Page 156.

PRECIPITATION DETECTION STATUS

PAGE 1 OF 2

COMMAND: ST,PRE

FEEDBACK:

OPER A/21

ASSIGNED PRECIPITATION CATEGORY

1 - SIGNIFICANT PRECIPITATION

ELEV ANGLE	RATE (dBR) THRESH	REFL (dBZ) THRESH	THRESH AREA (km2)	DETECTED AREA (km2)	DETECTED PRECIP CAT
0.5	4.0	30.0	5000	12875	1

EVENTS	DATE	TIME	TIME LEFT IN CAT 1
--------	------	------	--------------------

CAT 1 PRECIP LAST DETECTED	7/15/96	18:12	00:59:59
CAT 2 PRECIP LAST DETECTED	7/15/96	18:12	
DETECTION FUNCTION EXECUTED	7/15/96	18:12	

NOTES: AREA THRESH = NOMINAL CLUTTER + PRECIP AREA

Precipitation Processing Parameter Added

Introduction

Bi-Scan Maximization is one of the quality control steps used by the Precipitation Preprocessing Algorithm. Prior to Build 9.0 this technique compared the reflectivity values of the lowest 2 elevation angles at corresponding range bins from a range of 27 nm to the maximum range for applying Bi-Scan Maximization (MXRBI). The range bin with the highest reflectivity value was chosen for further precipitation processing. Beyond MXRBI, reflectivity data from the 0.5° slice are used.

A limitation of Bi-Scan Maximization is that it can increase overestimation of precipitation accumulations due to bright band contamination. If the melting level is intersected by the radar beam at 1.5° close to the radar, and again by the 0.5° slice further out, two areas of overestimated precipitation accumulations due to bright band contamination will be present on the precipitation products.

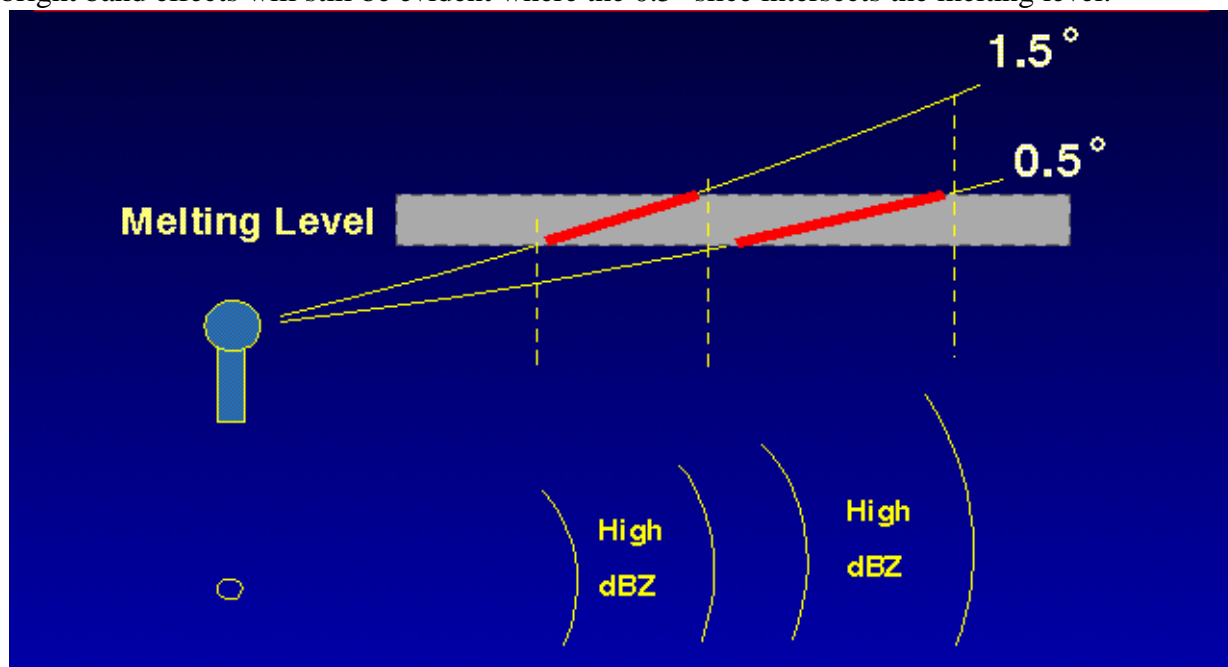
New parameter

With Build 9.0, a new parameter has been added to set the minimum range at which Bi-Scan Maximization is applied (MNRBI). The 0.5° slice is used from 27 nm to the range for which MNRBI is set. Bi-Scan Maximization is applied between the ranges defined by MNRBI and MXRBI.

Beyond MXRBI, the 0.5° slice is used. Both MNRBI and MXRBI are set at the Unit Control Position in the Preprocessing Precipitation Algorithm menu, under (AD,*****,M,*****,HY,P).

Operator impact

For bright band events, setting MNRBI and MXRBI beyond where the 1.5° slice intersects the melting level will reduce the amount of overestimation of precipitation accumulations due to bright band. Bright band contamination cannot be eliminated completely. Overestimations due to bright band effects will still be evident where the 0.5° slice intersects the melting level.



Separate Velocity Dealiasing Parameters For Long Pulse

The signal processor at the RDA assigns a “first guess” radial velocity to each range bin based on the average phase shift measured from a number of pulse pairs. The first guess assigned to each range bin will not be accurate if the mean velocity of the scatterers in that bin exceeds the maximum unambiguous velocity. The Velocity Dealiasing algorithm attempts to find the true radial velocity for each range bin with a bin-by-bin search along each radial, and performs a series of checks on the assigned velocity values.

The relatively low PRFs used to collect data in long pulse mode result in a maximum unambiguous velocity which is easily exceeded, resulting in more failures of the Velocity Dealiasing algorithm.

Separate menus are now available for both long and short pulse modes, which will provide separate adaptable parameters for each pulse length. This will improve dealiasing when long pulses are used to collect data.

Cross Section Endpoints Now Used At Applications Terminal

Introduction

Most graphic products at the PUP can be displayed either from the Graphic Tablet, or from the Applications Terminal. Cross sections were an exception in that the endpoints were not properly read from the Applications Terminal edit screen when the product was requested. This change allows operators to use either method for cross sections.

Operator Impact

Alphanumeric requests for cross sections using the Display, Graphics Menu (**D,G,RCS**) require the input of the azimuth and range of each endpoint using the PARAM1, PARAM2, PARAM3, PARAM4 edit fields. Before Build 9.0, the values for PARAM1 and PARAM2 always used the current default settings, not the values entered on the screen. Users may now request a cross section using either the Graphic Tablet or the Applications Terminal and be assured the correct PARAM1 and PARAM2 values will be used to generate the cross section. Other screens impacted include the Time Lapse Edit Screen and the Archive One Product Edit Screen.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume II, Applications Terminal, Page 2-71.

SWA Products From Same Volume Scan

Introduction

Occasionally when requesting ALL of the Severe Weather Analysis products (SWA), the resulting four panel display (SWR,SWV or SRR,SWW,SWS) would be from different volume scans. This could cause confusion when attempting to compare and interpret the four products. The change requires all of the products generated via this request to be from the same volume scan.

Operator Benefits

Using either the Graphic Tablet or Applications Terminal, the operator requests the SWA product suite (using the ALL/ONE SWA toggle if at the Graphic Tablet). Upon arrival, the products will display in a 4-panel mode, if the screen is clear, or can be selected via the ALL SWA PRODUCTS box in the product area. All times of products displayed will be from the same volume scan.

Reference:

- WSR-88D Operator Handbook, Principal User Processor, Volume I, Graphic Tablet, Page 1-39.

Cell Product Parameters

Introduction

This is a new menu at the UCP which allows the operator to control the size of several alphanumeric products and attribute tables. This may be important when considering items such as product transmission times and narrowband loadshedding.

Operator Impact

The “Cell Product Parameters” menu is found under the UCP “Selection of Product Parameters” menu. It is used to adjust the maximum number of storm cells in the following products:

	<u>Cells Per Page</u>
STI Alphanumeric Product	9
SS Alphanumeric Product	10
Hail Alphanumeric Product	10
STI Attribute Table	6
CR Combined Attribute Table	4
Hail Attribute Table	6

The primary reason for limiting the number of storm cells in products is to reduce the size of the products, and hence, reduce the chances for narrowband loadshedding. Product size is dependent on the number of pages formatted for display. If one cell is displayed on a page, an entire page is formatted, therefore adjustments should be made in increments of the number of cells per page. The parameters in this menu do NOT affect the number of storm cells identified and tracked, or the number of storm cells displayed in the STI and Hail graphic products, or available for Cell Trends data display. When changing these parameters, remember that all users of the product will be affected. It is NOT recommended that the number of cells for any product be reduced to less than 20. The upper limit is set at 100, which is the maximum number of storm cells which will be identified in any one volume scan.

Benefits / Limitations

The benefit of optimizing these parameters is to keep narrowband loadshedding to a minimum, while displaying the most number of cells. Limitations are that if too few cells are displayed, information is lost, while if too many are displayed, it takes longer to page through the information, and there is increased risk of narrowband loadshedding of products. An example of the Cell Product Parameters menu appears below.

Reference:

- WSR-88D Operator Handbook, Unit Control Position, UCP-1, Page 113.

```

                                CELL PRODUCT PARAMETERS                PAGE  1 OF  1
COMMAND: SE,***** ,CE,
FEEDBACK:                                OPER A/
      (M)ODIFY      (E)ND      (C)ANCEL
      DESCRIPTION                                RANGE      VALUE

```

MAXIMUM # OF CELLS IN STI ALPHANUMERIC PRODUCT	7 - 100	34
MAXIMUM # OF CELLS IN SS ALPHANUMERIC PRODUCT	10 - 100	40
MAXIMUM # OF CELLS IN HAIL ALPHANUMERIC PRODUCT	10 - 100	40
MAXIMUM # OF CELLS IN STI ATTRIBUTE TABLE	6 - 100	36
MAXIMUM # OF CELLS IN COMBINED ATTRIBUTE TABLE	4 - 100	32
MAXIMUM # OF CELLS IN HAIL ATTRIBUTE TABLE	6 - 100	36

```

6/20/96 16:27:10 NO STATUS CHANGE

```

See “Appendix D” on page 56 for additional enhancements included with Build 9.0.

Appendix A

Changes to Default RPG Adaptation Data

Build 9.0 contains several changes to default RPG adaptation data. The Build 9.0 software as delivered contains the changes described below:

1. VOLUME COVERAGE PATTERNS.

- a. The default PRF for VCP 11 and VCP 21 has been changed to PRF 4 for scans below 7 degrees elevation angle. PRF 4 increases the unambiguous range from about 80 nm (PRF 5) to 94 nm. However PRF 4 lowers the Doppler velocity Nyquist interval from about 50 knots (PRF 5) to about 42 knots, which may increase the number of velocity dealiasing errors.

Note that the default PRF was only changed at the RPG, not at the RDA. Also, the Auto PRF Selection algorithm cannot select PRF 4. Therefore, PRF 4 will only be used if the UCP operator downloads the RPG adaptation data VCP version to the RDA while the Auto PRF Selection algorithm is OFF. This allows the operator to change the unambiguous ranges between 80 nm and 94 nm without editing the current VCP, i.e., by issuing the **(RD,DO,21)** command, the unambiguous range will be 94 nm, and by issuing the **(RD,CH,21)** command, the unambiguous range will be 80 nm.

- b. The default SNR Thresholds for VCP 11 and 21 Doppler data have been lowered from 6 dB (48 on the VCP menu) to 3.5 dB (28 on the VCP menu). Note, this change has also been implemented at the RDA for local VCPs.

2. BACKGROUND MAP PAIRING

- a. USP (new product) - RIVER BASINS, RIVERS, COUNTIES, and STATES. Defined to be consistent with other precipitation products.
- b. CFC (new product) - RIVER BASINS, RIVERS, AIRPORTS, HIGHWAYS, CITIES. Maps of features that might be seen in the ground clutter.
- c. ET - Added WARNING AREAS and RESTRICTED AREAS maps.
- d. VWP - Removed AIRPORTS map.
- e. VIL - Added AIRPORTS map.
- f. STI - Added RADAR SITES map.
- g. HI - Removed RIVERS map.
- h. SS - Removed RIVER BASINS map.
- i. LRM (all layers) - Added AIRPORTS and NAVAIDS maps.

3. PRECIPITATION DETECTION FUNCTION

- a. The default value of the Precipitation Rate Threshold for Category 1 precipitation - **PRECIP RATE THRESH** has been increased from 1.0 dBR to 4.0 dBR. This increases the rainfall rate considered to be Category 1 precipitation to 0.1 inches per hour (from the Build 8.0 default of about 0.05 inches per hour) and the comparable reflectivity to about 30 dBZ (from about 26 dBZ). Since the radar uses this parameter to determine when to switch from Clear Air scanning mode to Precipitation mode, the net effect will be that the radar will remain in Clear Air mode for a somewhat longer time during a developing rainfall event before switching scan modes.

4. HYDROMETEOROLOGICAL ALGORITHMS

- a. **PRECIPITATION PREPROCESSING.** The default value of **MXPCT** has been increased from 50 percent to 75 percent. Increasing **MXPCT** should improve precipitation estimates, especially during shallow rainfall events and at longer ranges. However, it may increase the frequency of contamination of the precipitation products due to anomalous propagation.

The default value for **MXRBI** has been increased to 230 kilometers and a new parameter Minimum Range for Bi-scan Maximization - **MNRBI** has been added with a default value of 180 kilometers. Together, these parameters define the region within which the Bi-scan Maximization process is performed. The Level of Change Authority (LOCA) for these parameters has been defined as the URC.

The default values of **MXDBZ** and **MXRFL** have each been increased from 53 dBZ to 65 dBZ. This change is necessary to allow a full range of reflectivity values in the Radar Coded Message (RCM) product, which is being built from the Hybrid Scan Reflectivity data in Build 9.0. These parameters have been used as a hail threshold in rainfall rate. That threshold will now be defined by adjusting the parameter **MXPRA** in the Precipitation Rate algorithm.

- b. **PRECIPITATION RATE.** The default value for the Maximum Precipitation Rate - **MXPRA** has been lowered from 400 mm/hr to 103.8 mm/hr. **MXPRA** should be used to mitigate the precipitation overestimates caused by the high reflectivities associated with hail. The LOCA for **MXPRA** has been defined at the URC.
 - c. **PRECIPITATION ACCUMULATION.** The value of **ENGAG** should be zero (00) minutes. This value matches the parameter to the reporting characteristics of existing gage networks and allows maximum time for those reports to be received by the RPG.
 - d. **PRECIPITATION ADJUSTMENT.** The default value of **NSETS** has been decreased from 20 gage/radar pairs to 6 gage/radar pairs, the value of **THDIF** should be 15 minutes, and the value of **TBIES** should be 50 minutes. These values help optimize the Precipitation Adjustment algorithm performance considering the distribution and reporting intervals of existing operational rain gage networks.
5. **STORM TRACKING AND HAIL ALGORITHMS.** These algorithms have been replaced in Build 9.0 and consequently nearly all of the parameters have been modified. Many have been added or removed. Also, the UCP screen format for these algorithm parameters has changed

considerably. The following menus were modified: SEGMENTS, CENTROIDS OF COMPONENTS AND STORMS, TRACKING AND FORECAST, and HAIL. In some cases, the parameters that appear on these menus may be similar in meaning to Build 8.0, but they should be considered *totally new*.

6. ALERT THRESHOLDS EDIT SCREEN TABLES. Six alert categories have been replaced with new categories (caused by the replacement of the storm tracking and hail algorithms). Consequently, new thresholds have been set for categories 8, 12, 13, 25, 29, and 30. Also, the display format for category 15 (Max 1hr Accum) was changed from tenths of an inch to a decimal representation of inches.
7. COMBINED SHEAR PRODUCT ELEVATION SCAN. This product was changed to be generated (if requested) during the 0.5 degree elevation scan instead of the 1.5 degree scan used in Build 8. This change makes CPU usage more efficient and should reduce the likelihood of Input Buffer Loadshedding.
8. GENERATION AND DISTRIBUTION CONTROL MENU.
 - a. The default storage time for most products has been reduced from 360 minutes to 180 minutes. This change reduces the likelihood of Storage Loadshedding.
 - b. The following products were added to 'OTH USR' (NIDS) distribution:
 - i. CR (2.2 nm) in mode B.
 - ii. R (1.1 nm), lowest elevation scan, in mode A.
 - iii. SRM, lowest two elevation scans, in mode A.

Appendix B

Known Problems In Build 9.0

During testing of the Build 9.0 software, some problems were observed which were not corrected. All but item 4 at the RPG, existed in the Build 8 software. Described below are descriptions of problems, and/or functionality that should be avoided, along with work arounds (if available).

PROBLEMS OBSERVED AT THE PUP

1. **THIN RADIAL AT 135 AND/OR 315 DEGREES.** There is a RAMTEK problem where a thin (0.1 degree) radial is sometimes displayed at 135 (and to a lesser extent at 315) degrees azimuth. The thin radial is usually valid data from the 134 degree azimuth but has been mostly overwritten by a duplicate 135 degree radial. That is, the 135 degree azimuth is drawn twice. Incorrectly, just before the thin radial, and then again just after the thin radial at the proper location. Beware that the data contained in the radial just before very thin radials at these azimuths are probably invalid. This problem has always existed with all radial format products, and it occurs if specific azimuth angles are in the data near these azimuths. The Precipitation Accumulation Products are now in radial format, and always have the exact same azimuth angles in steps of 1 degree, and consequently the thin radial is often visible.
2. **RAPID DISCONNECT ON PUP DIAL-OUT LINE.** If a One-Time Request is made to a Non-Associated RPG and the connection is terminated at the PUP alphanumeric terminal before the line makes the connection, the RPG port that is dialed into will no longer connect to any user. If an incorrect Non-Associated RPG request is made, don't issue a line disconnection at the PUP until the line status at the PUP becomes "connected". Also, if an RPG dial line is suspected of having had the above scenario occur, at the UCP issue a line disconnect and then a connect.
3. **ARCHIVE IV START/CANCEL.** If you issue any Archive IV command (e.g., archive database) and then decide to cancel it, wait at least 15 seconds after the start Command (e.g., **A,A,D**) to issue the cancel. If you encounter a case where, archive is started and then commanded to cancel, and the feedback is "ARCHIVE UNIT 1 NOT ACTIVE", wait a bit longer and try the cancel again.
4. **ARCHIVE IV ERRORS.** If an archive function does not complete because of an error, then subsequent archive commands will result in message "Wait for Completion of Command". A PUPDOWN and PUPUP is required to access the optical disk again. If a PUPDOWN results in the message "Cancel Archive Before Bringing PUP Down" and you can't cancel it at the alphanumeric terminal, use MOUNTOFF at the system console, to mount the disk off and

then issue the PUPDOWN command.

5. **ARCHIVE IV SOFTWARE STAT.** If you ever see SOFTWARE STAT 813 or 817 at the PUP system status file, archive is not working properly. Cancel archive and bring the PUP down and back up.
6. **AUTO-ARCHIVE IV INCLUDING BKND MAPS.** Don't use auto-archive of received background maps option. It can cause auto-archive products to stop without notifying the operator. If received background map archive is desired, see Hotline Tales topic 2025.
7. **AUTO-ARCHIVE IV STATUS MESSAGES.** Don't use the auto-archive status only option (i.e., without including auto-archive products). Because if you issue a pause, it will indicate that the status is "not active" instead of "paused". A subsequent "resume" works okay, but subsequent "cancel commands" will not work.
8. **THP REPORTED BAD AT PUP.** After a disruption in the receipt of base data (e.g., wideband drop), if the Precipitation Processing Software reports a "Bad Scan" in the first volume scan after resumption of base data, the THP product for that volume scan will be reported as a Bad Product by the PUP. The graphic part of the product will be blank and the alphanumeric part is not displayable. Since the THP contains the same precipitation accumulation for each volume scan within the same clock hour, choose another THP product during the same clock hour instead.

PROBLEMS OBSERVED AT THE RPG

1. **RPG STANDBY OR RESTART.** There are a couple of problems that may occur after an RPG restart (or a Shutdown to Standby and subsequent Restart). They are: a) Narrowband Lines may change state to "Not Implemented", b) The RPG may lock up, c) S309M1 may pause (i.e., crash). Since an RPG restart, or shutting down to standby followed by a restart, does not have critical operational utility, it is recommended that this not be done. Instead, shut down the RPG to OFF (**U,SH,O**) and then bring it back up with RPGUP. If a Restart is necessary, it is recommended that the narrowband lines are issued a disconnect and sufficient time is provided to allow the lines to complete the disconnection. If S309M1 ever pauses during a shutdown, it must be canceled (i.e., CA S309M1) before the RPG can be brought back up. If narrowband lines become "Not Implemented", after shutting down the RPG to OFF (**U,SH,O**), it is often required to reboot at CDS level with PO OFF and subsequent PO ON.
2. **AUTO-ARCHIVE III STATUS MESSAGES.** On rare instances, after an power failure or RPGABORT, if status auto-archive was active, archive may issue the UCP message "Cannot Archive Status - Incompatible Class/ID" and auto-archive status will stop. If this happens, just issue the command to start status auto-archive. It will resume.
3. **DOWNLOADING CLUTTER MAPS TO RDA.** The UCP does not notify the user if the wideband line is disconnected when entering a command to download clutter maps (bypass or suppression regions) to the RDA. Therefore, make sure that the wideband line is connected

before sending clutter maps.

4. **PRCPDSTP HAS FAILED LOAD/START.** This message will always appear at the RPG Status Log during startup, and does not indicate a problem, since the Digital Storm Total Product was planned for Build 9.0, but was not completed. However, if this message ever appears for any other task, a serious problem is being reported that warrants investigation.
5. **INPUT BUFFER LOADSHEDDING IN VCP 300.** Input buffer loadshedding occurs in the next volume scan after completion of the Maintenance Volume Coverage Pattern (VCP 300). Base products are properly generated and the system recovers after changing to a different VCP.
6. **STATUS OF ARCHIVE LEVEL III IS INCORRECTLY REPORTED AS IDLE WHILE BACKGROUND MAP ARCHIVE IS IN PROGRESS.** When level III auto-archive products starts on a new disk (either side A or B), it takes around 30 seconds for the message "ARCHIVE BACKGROUND MAPS IN PROGRESS" to appear on the UCP Status Line, and it can be another 5 minutes for the "ARCHIVE BACKGROUND MAPS COMPLETED" message to appear on the UCP Status Line. The status of auto-archive products does not become ACTIVE until the message ARCHIVE BACKGROUND MAPS COMPLETED appears. If "start auto-archive products" is commanded during this time, the error message "Archive Device 1 UNAVAILABLE" will appear on the UCP Status Line, in the UCP Status Log, and auto-archive products will cancel. If "start auto-archive products" is commanded once more, double copies of products will be archived to the optical disk and will continue to be double archived, until auto-archive is restarted by commanding a Pause and Resume or Cancel and Start. To avoid this problem, ***DO NOT enter the start auto-archive products command while background maps are being archived.*** If you accidentally do this, wait until the message "Archive Device 1 UNAVAILABLE" appears on the UCP Status Line and then depending on the current status of archive (UCP command ST,AR), execute the following sequence of commands:
 1. If archive status is "AUTO ARCHIVE STATUS MESSAGES IS ACTIVE", command archive to PAUSE, then RESUME, then command start auto-archive products.
 2. If archive status is "ARCHIVE IS IDLE", command start auto-archive products, wait until the status become Active, then command archive to PAUSE, and then RESUME.
 3. If archive status is "AUTO ARCHIVE PRODUCTS IS ACTIVE" or "MULTIPLE ARCHIVE FUNCTIONS ACTIVE: AP, AS", command archive to PAUSE, then RESUME.

PROBLEMS OBSERVED AT THE RDA

1. **CAN'T WRITE TO NEW 8MM ARCHIVE II TAPE.** With a brand new 8mm tape, if archive II record is commanded and the status becomes LOADED but radial data is not written (e.g., RDA alarms caused an INOP condition, or RDA was in STANDBY) prior to bringing the RDA down, may not be able to write data to that tape (will get Archive II Load Error).

Appendix C

Additional Archive III and IV Improvements

Operating System includes Updated Optical Disk Driver and Utilities

The Build 9 RPG and PUP Operating Systems contain several corrections: a) A CDS level reboot can now be done without requiring that an optical disk is in the drive and spun up. This change requires a revision 6 or 13 Optical Disk Controller (ODC) board (per Mod 23 - Retrofit of Optical Disk Controller Board); b) Optical Disks will not encounter errors 37 and 42 due to power failures and become unmountable; c) Archive will not stop without notification if the limit of bad sectors is exceeded (usually caused by optical disk drive problems). Instead the 840B error (relocation area full) is now reported to the applications task; d) The RECVRALL utility now recovers optical disks that were previously unrecoverable.

More Informative Archive III Messages at the UCP

Messages now specify the operation that was executing when the error occurred (e.g. mount, read, write, filename, status). Status codes refer to Concurrent manuals. Most archive level III messages now say "Arc3" and provides a filename of file problem occurred with. This is the second phase of a multi-build effort to improve archive III status and error messages.

More Timely Archive III Utilization Warning/Alarm Messages

Previously didn't get archive III percent utilization until the first product file was filled (which could be over an hour after auto-archive is started). For write operations, utilization calculation is now done on file open and close. If the optical disk's utilization is already in the warning state, archive utilization warning messages will be triggered when auto-archive is started.

Optical Disk File Structure Integrity Check and Data Recovery

Previously, if the PMASTER.DIR file was ever deleted (probably during a power failure), when archive III resumed it would start deleting and reallocating product files. Now, if the system comes up and an archive write is attempted, the disk is checked and if the PMASTER.DIR file is missing but a product data file exists, then PMASTER.DIR is re-created from P-.IND files. Also, if P-.DAT files exist without a corresponding P-.IND file, then product data files are inspected to recreate the P-.IND files. There were similar changes for Archive IV.

Background Map Archive

Several sites could not archive background maps (88D9 error was seen). Error occurred on PUP and RPG (both were fixed) but with different map files since the files are read differently. Map files can now be archived however Error 28 on LU 21 may be seen at the system console.

Appendix D

Additional Enhancements

Unexpected Start of Volume Caused RPG CPU Overestimates

Previously, when a volume scan aborted, CPU consumed during the partial scan was added to next full scan for RPG CPU utilization estimates. This caused projected CPU usage to be overestimated. Now CPU consumed in aborted scans are ignored.

RPG Product Database Handling and Storage Loadshedding

Previously, when a volume scan aborted, the products that were supposed to have aged out weren't removed as expected. Products from the current scan could get deleted at the end of the volume scan if the storage time was 360 minutes and if 8 volume scan aborts occurred since the last RPG startup or restart. Now products are properly aged out. Also, if a storage time is not specified, products are now stored for 6 volume scans (instead of 2) and they are not shed during storage loadshedding.

Wideband User Problems Interrupted Data Flow between the RDA and RPG

The RPG Alarms menu and Loadshed Categories menu now include a Wideband User category, and there are new Wideband User Loadshed status messages. When the alarm level is reached, wideband user buffers are flushed to prevent buffer pool exhaustion (which can cause the RDA/RPG wideband line to drop). Data flow to the wideband user will resume immediately and will stay connected. Wideband User utilization will be blank if the line isn't connected.

Wrong Product Requested by PUP

This problem occurred when a product not in the database was requested from the PUP Alphanumeric Terminal. After this product was received, a request of a different product from the Graphics Tablet that was in the database could lead to the previous product being requested (and received) again.

One-Time Requests Not Processed After S309M1 317 Error 1

Problem occurred when PUP transmission queue filled up (error 317). Problem occurred at PUP using two dedicated lines with error 317 occurring on one line. Two changes were made: 1) Transmission queue size increased at PUP to 10 requests; 2) If transmission queue fills up, then software drops line (with requested disconnect message) and reconnects.

Garbled Time Lapse Feedback Message

Previously, an operator could lock up the graphics tablet or get garbled messages when the frame size (i.e. product size) was too large for time lapse. When frames are too large (about 54 Kbytes), they are skipped and a new feedback message is triggered to indicate how many frames were skipped. Still won't display frames that are too large.

PUP Alert Editing Box Colors Correction

Color of boxes was not consistent when adding individual boxes on alert areas (color was reversed). Now alert area 1 is yellow, 2 is blue.

Invalid Velocity and Reflectivity Data on Batch Cuts

Previously, within batch cuts invalid Reflectivity and Doppler data was displayed in the first range bin beyond the Doppler unambiguous range. Valid data is now displayed in the location, however the hole of missing data at the radar location is now larger within the batch cuts.